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Primary Relationships, HIV Treatment Adherence, and Virologic Control

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Abstract

To identify factors associated with antiretroviral therapy (ART) adherence and virologic control among HIV-positive men on ART in primary relationships, data were collected from 210 male couples (420 men). Dyadic actor–partner analyses investigated associations with three levels of adherence-related dependent variables: self-efficacy (ASE), self-reported adherence, and virologic control. Results indicated that higher patient ASE was related to his own positive beliefs about medications, higher relationship autonomy and intimacy, and fewer depressive symptoms. Fewer depressive symptoms and less relationship satisfaction in the partner were linked to higher ASE in the patient. Better self-reported adherence was related to the patient's positive appraisal of the relationship and the partner's positive treatment efficacy beliefs. Greater medication concerns of both patient and partner were associated with less adherence. The partner's higher relationship commitment was associated with lower viral load in the patient. Findings suggest that depressive symptoms, treatment beliefs, and relationship quality factors of both partners may influence adherence-related outcomes.

Keywords

HIV; AIDS; Adherence; Compliance; Couples; Depression; Primary relationships; HIV treatment adherence; Virologic control

Introduction

Social isolation, limited social networks, and low levels of social support are associated with increased morbidity and mortality in a wide range of medical contexts [1–4], to the degree that the mortality risk associated with low social support is estimated to be equal to that of cigarette smoking [5]. Associations between quality of social support and health outcomes have been documented in high-risk pregnancy [6], chronic pain [7] and diabetes [8], as well as cancer and numerous other health conditions [9–12]. In a broad range of populations and disease conditions (e.g., diabetes, hypertension), and varying age groups, treatment regimens, and measurement strategies, there is evidence of robust correlations between practical and emotional support and treatment adherence [13]. In the context of HIV infection, social support has been linked to better adjustment [14–19], better treatment adherence [20], and slower progression to AIDS [13, 18, 21, 22]. The purpose of this study

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is to present findings from an analysis of couples in which we investigated relationship-based predictors of adherence factors.

Studies have identified the presence of a primary partner as a fundamental factor in maintaining health [23]. Married men have been found to have a greater likelihood of survival over time than their unmarried counterparts, after controlling for risk indicators [5], and the hypothesized mechanisms by which partnerships influence health behaviors and outcomes are varied [12, 24]. Better health outcomes have been linked to higher levels of primary relationship communication, intimacy, and satisfaction. Among married patients with rheumatoid arthritis, positive indicators of marital adjustment (positive communication, intimacy) were related to lower depressive symptoms in both the patient and spouse and lower illness-related stress in the patient. Conversely, greater conflict and unsupportive interactions are associated with negative health outcomes [25–27]. In one review, negative dyadic interactions affected relationship quality and brought about reductions in support, which can lead to poorer health behaviors, such as sedentary behavior and substance abuse [12]. For example, people who report being unhappy in their marriages also report more illness and depression, heavier drinking, and more isolation from persons outside of the marriage than do happily married individuals [28].

While psychoneuroimmunologic work has documented direct physiological and immunologic effects from stressful dyadic interactions [29, 30], influences on treatment adherence by primary partners and spouses is likely a driving factor in the associations between relationship status and health among persons with medical conditions requiring long-term treatment. Among patients with coronary heart disease, those who were married or had a partner were more likely to attend cardiac rehabilitation than those who were single [23]. In another study, being married was associated with better adherence to antihypertensive medications [31], and a meta-analysis examining studies representing a broad range of treatments found that adherence was worse when there was evidence of spousal and family conflict [13]. Among patients with diabetes, for example, rigid family control was associated with poorer adherence to medication [32], and lower marital satisfaction was associated with poorer adjustment following diabetes diagnosis [33, 34].

The importance of high adherence to antiretroviral therapy (ART) for HIV disease is well documented, and poor adherence can lead to hastened disease progression, ART resistance, increased health care costs, morbidity, mortality, and heightened risk of secondary HIV transmission [35–38]. Research on the associations between relationship factors and adherence to ART is lacking. In one study, being in a primary relationship was associated with lower levels of adherence to ART, after controlling for other adherence predictors in multivariate modeling [20, 39]. More recently, this finding was replicated in a study by Knowlton in which women without a primary partner reported better adherence than women with partners [40]. In contrast is a report in which perceived social support from romantic partners was associated with higher ART adherence than similar levels of support from people other than partners [41]. Theodore found that low relationship intimacy among HIV-positive gay men taking ART was related to poor ART adherence [42]. To date, one intervention study has demonstrated a significant improvement in ART adherence when intervening with couples [43].

These findings, combined with our qualitative work, suggest that there are complex interactions among relationship dynamics, partner support for adherence, and medication adherence [44, 45]. However, no studies have documented the concurrent associations of each partners' variables on ART adherence. The purpose of our study is to explore these associations among male couples. We focus on the associations between levels of patient and partner depressive symptoms, treatment beliefs, and indicators of relationship quality on

the ART adherence-related outcomes of self-efficacy, self-reported adherence, and virologic control.

Methods

Design

Findings are from a cross-sectional phase of a study of same-sex male couples in which at least one partner is HIV-positive and taking ART.

Participants

Couples were recruited in the U.S. San Francisco Bay Area using passive recruitment methods and participant and provider referrals. Flyers were posted in clinics, community bulletin boards, AIDS service organizations, and other community based organizations, and media ads were placed in publications targeting HIV-positive and gay and bisexual men. Participants were eligible for the study if they met the following criteria: (1) in a primary relationship, defined as "currently (for at least 3 months) in a relationship with someone to whom you feel committed above anyone else and with whom you have had a sexual relationship;" (2) both partners at least 18 years old, born male and currently identify as male; (3) at least one partner is HIV-positive and on an acknowledged ART regimen for at least 30 days; (4) English speaking; and (5) able to provide informed consent.

Procedures

All procedures were reviewed and approved by the Committee on Human Research, the Institutional Review Board (IRB) at the University of California, San Francisco. Couples who called the study phone were screened separately for eligibility criteria over the phone, and eligible couples were scheduled for an in-person interview at the study's research offices; both partners were required to attend assessment appointments together, but they were separated during the consenting process and data collection. Data were collected with a combination of Computer Assisted Personal Interviewing (CAPI) and Audio Computer Assisted Self Interviewing (ACASI) procedures to maximize data integrity through reduction of data entry errors and minimization of social desirability effects [46]. Blood draws were conducted with HIV-positive partners during the assessment visit. Participants were paid US $50 each for completing the survey and an additional US $10 for providing a blood sample. All interviews took place between January 2009 and September 2010.

Measures

The following measures were used in the study's survey instrument. All as reported are for the study sample.

Background and Control Variables—Detailed demographic and treatment data included participant age, race, ethnicity, educational level, length of time since HIV-positive serostatus was first known, current ART and regimen complexity. Total number of pills in the ART regimen was used as an indicator of regimen complexity. Length of relationship and whether and how long the couple had been living together was asked.

Explanatory Variables

Treatment Beliefs: Treatment beliefs were assessed using the HIV version of the Beliefs About Medications Questionnaire (BMQ) [47], which includes subscales of general medication concerns, treatment necessity, and treatment concerns (α range = 0.70–0.83 for the three scales). Partner versions of the treatment necessity and concerns subscales were

created to mirror the items that the HIV-positive respondents completed regarding their own treatment (α range = 0.62–0.79 for the two subscales).

Depressive Symptoms: The Center for Epidemiologic Studies Depression Scale (CES-D) [48] was administered to measure depressed mood in the past week. The CES-D consists of 20 items rated on a 4-point scale according to how frequently they were experienced in the previous week (α = 0.91).

Relationship Quality: Several dimensions of relationship quality were assessed.

Relationship satisfaction: The 4-item Couples Satisfaction Index [49] measured relationship satisfaction (α = 0.93). We also administered the 6-item Dyadic Adjustment Scale [50, 51] which taps into perceptions of how well things are going in the relationship and how often the partners confide in each other, laugh together, and calmly discuss matters (α = 0.84). We administered an adapted set of scales from Kurdek's work with couples which assess relationship commitment (four items; α = 0.96), intimacy (six items; α = 0.76), autonomy (five items; α = 0.74), and equality (eight items; α = 0.91) [52]. Constructive relationship communication was assessed with a 5-item constructive communication subscale created from the 11-item Communications Patterns Questionnaire [53] (α = 0.89).

Dependent Variables—*Adherence self-efficacy*, or confidence in one's ability to comply with a treatment plan, has been consistently linked to adherence over time. The HIV-ASES scale assesses patient confidence in carrying out health-related behaviors (e.g., asking physician questions, keeping appointments, adhering to medication) [54]. This measure, which includes two subscales (integration and perseverance; α = 0.88 and 0.69) was associated with ART in previous research [20].

Adherence to antiretroviral medications was assessed using 2 well-validated measures of self-report. First, the adherence measure developed to assess adherence in the AIDS Clinical Trials Group (ACTG) [55] provides detailed information about adherence over the prior 3 days. Adherence scores on this scale have been correlated with viral load [55, 56], and we have computerized this measure for other studies with good success [20]. A percent adherence score is obtained by dividing the number of pills reported taken over the past 3 days by the number that were prescribed. Second, the visual analog scale (VAS) developed by Walsh was administered [57]. This measure assesses 30-day adherence reporting separately for each drug along a continuum anchored by "0" to "100%." This measure has shown to be correlated with other adherence measures such as electronic medication monitors [58, 59], and a 30-day timeframe has recently been supported as preferable to other approaches of self report [60]. Both measures were dichotomized as 100 versus <100% adherence.

Clinical status was assessed by viral load assays. Trained phlebotomists using standard techniques obtained blood for plasma HIV RNA viral load during the assessment interview visit. The viral load test was performed using the COBAS® AmpliPrep/COBAS® TaqMan® HIV test kit (Roche Molecular Systems, Inc.), which has a threshold for undetectability ≤48 copies/ml. Viral load was dichotomized as detectable versus undetectable.

Data Analysis

One-way frequency tables and measures of central tendency were generated to characterize the sample. Inferential analyses used the actor–partner analysis approach to investigate the effects of individuals' and their partners' explanatory variable effects on individuals' adherence self-efficacy, adherence, and viral load [61]. In actor–partner analysis, multilevel

regression analysis (also known as hierarchical linear modeling or HLM) is used to regress an individual respondent's outcome score onto his own explanatory variables to detect possible actor effects and the corresponding explanatory variables from his partner to detect possible partner effects. For example, if Fred and Bill are a couple and the outcome is adherence and an explanatory variable is depressed mood and the researcher wants to model adherence as a function of depressed mood, multilevel regression analysis is used to model Fred's and Bill's adherence as a function of Fred's and Bill's depression scores. In the actor–partner analysis, Fred's adherence score is regressed onto Fred's own depression score and Bill's adherence score is regressed onto Bill's own depression score. The regression coefficient of participants' adherence outcomes onto their own depression scores represents the mean *actor effect* for depressive symptoms across all participants because participants' own depression scores are predicting their adherence. The analysis also permits Fred's depression score to influence Bill's adherence and Bill's depression score to influence Fred's adherence. The regression coefficient of participants' adherence outcomes onto their partners' depression scores represents the mean *partner effect* for depression across all participants because participants' partners' depression scores are predicting participants' adherence. Multilevel (HLM) analysis is used to fit actor–partner regression models because outcome scores are correlated within couples and it is necessary to account properly for that correlation to obtain correct standard errors and test statistics. The actor–partner terminology used in basic behavioral couples research may not be familiar to a wider range of researchers and clinicians, so, in keeping with the focus on studying HIV-positive men who are taking ART, in this paper we use the term *patient* to refer to the actor or respondent and *partner* to refer to his partner.

Initial unadjusted analyses identified pairs of patient and partner explanatory variables with p values of 0.25 or less for inclusion into subsequent multivariable models. This criterion was chosen based on simulation study results reported in Hosmer and Lemeshow's text *Applied Logistic Regression* that showed that the 0.25 cutoff provided good balance between Type 1 error management versus failing to include potentially important correlates. Explanatory variables in multivariable models were removed one at a time starting with the variable with largest p value until all remaining explanatory variables' effects were significant at $p < 0.05$ [62].

For binary outcomes (e.g., 3-day adherence; 30-day adherence; detectable viral load) actor–partner analysis was performed using generalized estimation equations (GEE) clustering on the couple ID with an exchangeable correlation structure, a binary distribution, and a logit link function to yield odds ratios. Actor–partner analyses for continuous outcomes (e.g., adherence self-efficacy integration and perseverance) were performed using linear mixed models with a compound symmetric (CS) correlation structure to model autocorrelation among members of the same couple [61]. Model assumptions were assessed by examining univariate histograms of Cholesky-scaled residuals and scaled residuals-by-predicted value plots [63]. If model assumptions were violated, the HC3 heteroskedastic consistent estimator was substituted for the default model-based estimator [64]. SAS 9.22 was used to perform the analyses.

Given the literature on ART adherence and social support [44, 45, 65–67], the following were evaluated as potential confounders in all multivariable models: age, length of time on ART, regimen complexity, whether the couple was living together, relationship length, and couple serostatus (concordant HIV-positive = 1; serodiscordant = 0). The explanatory variables of interest were incorporated separately for patient and partner and included score of depressive symptoms; BMQ general medication concerns, treatment necessity, and treatment concerns; and relationship satisfaction, communication, commitment, autonomy, equality, and intimacy. The dependent variables in the models were the two adherence self-

efficacy scales (integration and perseverance), the 3-day and 30-day self-reported ART adherence scores, and virologic suppression (detectable vs. undetectable).

Results

Sample Characteristics

In response to recruitment efforts, 791 individuals called the study screening line. Of those, 658 were interested in the study and agreed to be screened, with 482 men meeting the study's basic eligibility criteria. Analyses include 420 men comprising 210 couples who scheduled appointments and completed the one-time interview. The sample was largely middle-aged (mean = 45.2 years; SD = 10.10 years) and white (58.6%), though significant numbers of black and Latino men participated as well (approximately 18% for each group; see Table 1).

Inferential Analyses

Of the 420 men, 91 were HIV-negative and 34 were HIV-positive but not taking antiretroviral medications. The remaining 295 HIV-positive men on ART supplied outcome data for inferential analyses with their own explanatory variables serving as patient variables and their partners' responses serving as partner explanatory variables. Inferential results for the adherence self-efficacy integration and perseverance measures appear in Table 2. In unadjusted models, adherence self-efficacy integration showed negative patient effects for depressive symptoms, BMQ general concerns, and BMQ concerns, and positive patient effects for communication, autonomy, and equality. For instance, greater depressive symptoms in the patient was associated with his own lower adherence self-efficacy integration while better communication was associated with his own higher adherence self-efficacy integration. Further, the patient's adherence self-efficacy integration was negatively associated with his partner's depressive symptoms, BMQ general concerns, BMQ concerns, communication, autonomy, and intimacy and positively associated with his partner's commitment to the relationship. For instance, greater depressive symptoms in the partner was associated with lower adherence self-efficacy integration in the patient while better communication scores of the partner were associated with higher adherence self-efficacy integration in the patient. Thus, depressive symptom scores and communication exert both patient and partner effects on adherence self-efficacy integration in the patient. In the final adjusted multivariable model, age ($B = 0.24$; 95% CI = 0.09, 0.38; $t(80) = 3.25$, $p = 0.002$) and autonomy ($B = 0.20$; 95% CI = 0.07, 0.34; $t(80) = 2.94$, $p = 0.004$) showed positive patient effects on adherence self-efficacy integration, whereas time on medications ($B = -0.38$; 95% CI = −0.59, −0.18; $t(80) = -3.71$, $p = 0.0004$) and BMQ concerns ($B = -0.86$; 95% CI = −1.15, −0.58; $t(80) = -6.05$, $p < 0.0001$) showed negative patient effects, and level of depressive symptoms showed a negative partner effect ($B = -0.12$; 95% CI = −0.23, −0.01; $t(80) = -2.19$, $p = 0.03$).

For adherence self-efficacy perseverance, unadjusted analyses showed negative patient effects for depressive symptoms, BMQ general concerns, and BMQ concerns, and positive patient effects for couple and dyadic satisfaction scores, communication, commitment, autonomy, equality, and intimacy. Unadjusted analyses also showed negative partner effects between adherence self-efficacy perseverance and the couple satisfaction score, communication, autonomy, equality, and intimacy. In adjusted analyses, the final multivariable model included positive patient effects between adherence self-efficacy perseverance and autonomy ($B = 0.10$; 95% CI = 0.03, 0.17; $t(78) = 2.80$, $p = 0.01$) and intimacy ($B = 0.10$; 95% CI = 0.03, 0.16; $t(78) = 2.86$, $p = 0.01$), and negative patient effects for adherence self-efficacy perseverance and time on medications ($B = -0.09$; 95% CI = −0.18, −0.01; $t(78) = -2.12$, $p = 0.04$), depressive symptoms ($B = -0.07$; 95% CI = −0.13,

−0.01; $t(78) = -2.39$, $p = 0.02$), BMQ general concerns ($B = -0.15$; 95% CI = −0.27, −0.03; $t(78) = -2.56$, $p = 0.01$), BMQ concerns ($B = -0.26$; 95% CI = −0.41, −0.10; $t(78) = -3.25$, $p = 0.002$), and a negative partner effect for the couple satisfaction score ($B = -0.19$; 95% CI = −0.33, −0.06; $t(78) = -2.78$, $p = 0.01$; Table 2).

Table 3 shows unadjusted and adjusted model results for the 3-day and 30-day adherence outcomes. In unadjusted analyses for 3-day adherence, there were negative patient effects for BMQ general concerns and BMQ concerns, and positive patient effects for equality and intimacy. Also, for 3-day adherence there was a positive partner effect for BMQ necessity and a negative partner effect for communication. In adjusted analyses, the final multivariable model for 3-day adherence included negative patient effects for regimen complexity and BMQ general concerns, and a positive partner effect for BMQ necessity. For 30-day adherence, negative patient effects for level of depressive symptoms and BMQ concerns emerged for adherence whereas a positive patient effect for communication was found for 30-day adherence in unadjusted analyses. Partner effects for 30-day adherence in unadjusted analyses included negative effects for BMQ general concerns and BMQ concerns plus positive effects for couple satisfaction, dyadic satisfaction, and commitment to the relationship. In adjusted analyses, the final multivariable model for 30-day adherence included a negative patient effect of time on medications (OR = 0.94; 95% CI = 0.91, 0.98; $z = -2.84$, $p = 0.01$), a positive patient effect of communication (OR = 1.05; 95% CI = 1.01, 1.10; $z = -2.54$, $p = 0.01$), and a negative partner effect of BMQ general concerns (OR = 0.92; 95% CI = 0.86, 0.99; $z = -2.14$, $p = 0.03$).

Table 4 illustrates unadjusted and adjusted model results for the detectable HIV viral load outcome. In unadjusted analyses, having a detectable viral load was positively associated with level of patient depressive symptoms, BMQ concerns, and intimacy, and negatively associated with BMQ necessity. Having a detectable viral load was also associated with negative partner effects for BMQ necessity, couple satisfaction, and relationship commitment. In adjusted analyses, the final multivariable model for having a detectable viral load contains a positive effect for couple serostatus (OR = 1.84; 95% CI = 1.07, 3.18; $z = 2.21$, $p = 0.03$), indicating that HIV-positive couples are more likely to have a member with a detectable viral load, and a negative partner effect for commitment (OR = 0.95; 95% CI = 0.92, 0.99; $z = -2.62$, $p = 0.01$), such that the higher the partner's report of relationship commitment, the less likely the respondent has a detectable viral load.

Discussion

Using data from both members of the couple, our findings offer compelling support for the investigation of partner perspectives and relationship quality indicators in the context of HIV treatment adherence. Consistent with the literature on individual determinants of ART adherence, treatment adherence self-efficacy appears to be related to a patient's beliefs about treatment benefit, concerns about medication harms, and the degree of his own depressive symptoms. Within the context of couples, our study presents the emergence of the patient's appraisal of relationship quality as a significant correlate of his adherence self-efficacy. Our findings suggest that greater relationship autonomy and intimacy may facilitate more confidence in one's ability to adhere to treatment. Perhaps greater autonomy indicates less dependence on the partner, and thus less reliance on the partner for adherence support. Also unique to the study are the findings that the partner's depressive symptoms are negatively linked to how well the patient gauges his own ability to adhere to treatment. Greater depressive symptoms in the partner may signal adherence difficulties in the patient, offering new insights into potential obstacles to adherence self-efficacy and intervention opportunities centered on the partner.

The adherence self-efficacy findings above do not necessarily translate to actual nonadherence, as indicated by the results of the self-reported adherence analyses. Rather, it appears that a patient's appraisal of healthy relationship communication is linked to his own reports of better adherence. However, the partner's treatment beliefs (both positive and negative) are linked to the patient's adherence in the expected directions. That is, the partner's more positive beliefs of treatment efficacy and fewer concerns about general medication overuse or harm were associated with the patient's better adherence. Although never previously documented in the context of couples and HIV treatment, this finding parallels findings by Doherty, in which a male patient's adherence to a coronary health treatment plan was predicted by his wife's beliefs about treatment efficacy [68]. Our study offers a more robust test of this relationship, as the patient's own beliefs were included in the same model, as were other known correlates of nonadherence.

Our sole finding related to the patient's viral load was that the greater the level of relationship commitment endorsed by the partner, the more likely it was that the patient had an undetectable viral load and thus was responding well to treatment. It is intriguing that none of the variables related to depressive symptoms, treatment beliefs, regimen complexity nor the patient's own appraisal of the couple's relationship quality were linked to virologic control outcomes. Because the study was cross-sectional, the presence and direction of any causal associations between the partner's reported commitment and the patient's successful viral suppression cannot be determined.

The finding that the partner's report of higher relationship satisfaction is related to the patient's lower adherence self-efficacy was surprising and initially counter-intuitive. However, when considered alongside the finding that the patient's higher rating of autonomy was associated with higher self-efficacy, these findings may indicate that a high degree of comfort and dependence in the relationship may result in an erosion of one's confidence to independently manage health issues such as ART adherence. It is important to note that these associations did not carry forward into actual adherence reporting or virologic control, but rather were confined to perceptions of confidence in one's ability to adhere. More investigation is needed to disentangle the dimensions of relationship autonomy, satisfaction, and commitment in the context of managing HIV care. The presence of partner effects in addition to patient effects indicates that adherence is an interpersonal phenomenon, not just an intrapersonal one, and as such is a product of a relationship process [69]. This underscores the importance of conducting couples-based research, as focusing solely on individual-level factors may leave important pathways of influence on behavior undetected.

Our findings should be evaluated in light of the study limitations. The data are cross-sectional and rely on self-reported adherence data, which may be subject to social desirability and thus inflated, and causal interpretations cannot be inferred. Although these findings paint a rich picture of relationship and partner variables that appear to influence adherence, they do not delineate the mechanisms by which partner and relationship variables may lead to better treatment adherence and health outcomes. Future research is needed to clarify how such factors as relationship quality, partner beliefs and depressive symptoms influence or co-occur with patient treatment adherence and clinical outcomes. The couples in the study were all male and from one geographic region, which restricts generalizability to other couple types, contexts, and regions. Further, other participant characteristics such as age, race, ethnicity, length of time on ART, relationship length, and level of ART adherence should be considered when extrapolating these findings to other groups and settings.

The study findings have implications for research and for clinical care delivery. In addition to determining mechanistic pathways, future investigations are needed to explore these

effects over time; whether they are similar in heterosexual couples and couples across cultures; and how findings may differ for seroconcordant and serodiscordant couples. Although the analysis results, which included couple serostatus as a control variable, did not suggest an effect of couple HIV seroconcordance, there is evidence in the broader health literature that suggests concordance may be relevant [70]. For instance, if both partners in a couple smoke, it is unlikely that one partner will be able to successfully quit while the other continues to smoke [71], and relapses are likely when one partner stops smoking independently [72, 73]. How this may play out in the context of HIV seroconcordance has not yet been determined. For example, if a couple is HIV serodiscordant, high adherence and thus good virologic control may reduce the risk of infection to the HIV-negative partner. Therefore, the HIV-negative partner may have more vested interest in his partner's adherence and may take a more active role in fostering adherence. Alternately, in concordant couples in which both partners are on ART, there may be greater opportunity to model and support adherence behaviors and to develop adherence systems that benefit both partners. Larger samples of HIV-positive concordant and discordant couples are needed to determine if the pattern of results found here diverge for couples who differ in serostatus composition.

From a health care perspective, our findings suggest that it may be important to view the patient's relationship as a consideration in clinical care. We have previously reported that a partner's appraisal of the patient's adherence has as strong a relationship—or even stronger—with the patient's viral load than does the patient's own self-reported adherence [74]. Understanding both patient and partner perspectives on the health of their relationship, and having a sense of the partner's level of depressive symptoms and beliefs about HIV treatment may help providers effectively counsel their patients about medication adherence, thereby optimizing treatment benefit among HIV-positive men in relationships.

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Table 1

Sample characteristics

	HIV+ (*n* = 329)	**HIV− (*n* = 91)**	**(*N* = 420)**
Age (years) *m* (SD)	44.7 (9.8)	47.1 (11.1)	45.2 (10.1)
Race	–	–	–
Black/African American (%)	19.5	12.1	17.9
White (%)	56.8	64.8	58.6
Other (%)	23.7	23.1	23.6
Latino ethnicity (%)	18.5	15.4	17.9
Sexual orientation	–	–	–
Heterosexual (%)	0.6	1.1	0.7
Homosexual (%)	89.4	89.0	89.3
Bisexual/other (%)	10.0	9.9	10.0
Education	–	–	–
<High school (%)	5.5	3.3	5.0
High school (%)	28.3	18.7	26.2
Some college (%)	27.7	22.0	26.4
College grad. (%)	38.6	56.0	42.4
Months as a couple, *m* (SD)	75.4 (74.5)	98.6 (95.5)	80.4 (80.0)
Viral load undetectable, %	76.9	NA	76.9
Months since HIV+, *m* (SD)	152.6 (95.2)	NA	152.6 (95.2)
Months on ART, *m* (SD)	112.0 (82.9)	NA	112.0 (82.9)

Table 2

Actor–partner analyses for adherence self-efficacy

Explanatory variables	*B* (95% CI)			
	ASES–Integration		ASES–Perseverance	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Potential confounders				
Age (actor)	–	0.24 (0.09, 0.38)**	–	–
Time on meds (actor)	–	−0.38 (−0.59, −0.18)***	–	−0.09 (−0.18, −0.01)*
Regimen complexity	–	–	–	–
Living together	–	–	–	–
Relationship length	–	–	–	–
Couple serostatus	–	–	–	–
Patient				
Depressive symptoms	−0.23 (−0.36, −0.11)***	–	−0.12 (−0.18, −0.06)***	−0.07 (−0.13, −0.01)*
BMQ: General concerns	−0.50 (−0.75, −0.25)***	–	−0.27 (−0.39, −0.15)***	−0.15 (−0.27, −0.03)*
BMQ: Necessity	0.14 (−0.19, 0.48)	–	−0.08 (−0.24, 0.08)	–
BMQ: Concerns	−0.87 (−1.17, −0.57)***	−0.86 (−1.15, −0.58)***	−0.39 (−0.53, −0.24)***	−0.26 (−0.41, −0.10)**
Relationship quality				
Satisfaction—CSI	0.11 (−0.22, 0.44)	–	0.17 (0.02, 0.33)*	–
Satisfaction—Dyadic	0.14 (−0.16, 0.45)	–	0.12 (−0.03, 0.26)†	–
Communication	0.24 (0.05, 0.43)*	–	0.10 (0.01, 0.18)*	–
Commitment	0.03 (−0.19, 0.25)	–	0.08 (−0.03, 0.18)†	–
Autonomy	0.20 (0.05, 0.35)*	0.20 (0.07, 0.34)**	0.08 (0.01, 0.15)*	0.10 (0.03, 0.17)**
Equality	0.20 (−0.01, 0.41)†	–	0.13 (0.03, 0.23)**	
Intimacy	0.05 (−0.09, 0.20)	–	0.08 (0.01, 0.15)*	0.10 (0.03, 0.16)**
Partner				
Depressive symptoms	−0.11 (−0.23, 0.01)†	−0.12 (−0.23, −0.01)*	−0.003 (−0.06, 0.05)	–
BMQ: General concerns	−0.19 (−0.44, 0.07)†	–	−0.05 (−0.17, 0.07)	–
BMQ: Necessity	−0.06 (−0.46, 0.33)	–	−0.07 (−0.26, 0.12	–
BMQ: Concerns	−0.18 (−0.47, 0.10)†	–	−0.07 (−0.25, 0.11)	–
Relationship quality		–		–
Satisfaction—CSI	−0.07 (−0.39, 0.26)	–	−0.14 (−0.30, 0.01)†	−0.19 (−0.33, −0.06)**
Satisfaction—Dyadic	0.01 (−0.28, 0.30)	–	−0.001 (−0.14, 0.14)	–
Communication	−0.12 (−0.31, 0.07)†	–	−0.08 (−0.17, 0.01)†	–
Commitment	0.16 (−0.06, 0.38)†	–	0.001 (−0.10, 0.11)	–
Autonomy	−0.13 (−0.29, 0.03)†	–	−0.08 (−0.16, −0.01)*	–
Equality	−0.02 (−0.23, 0.19)	–	−0.09 (−0.19, 0.01)†	–
Intimacy	−0.11 (−0.26, 0.05)†	–	−0.05 (−0.12, 0.03)†	–

$N = 295$ for each unadjusted analysis and $N = 294$ for adjusted analyses due to one participant missing time on medications information

CSI Couple Satisfaction Index

$^{\dagger} p < 0.25$;

$^{*} p < 0.05$;

$^{**} p < 0.01$;

$^{***} p < 0.001$

Table 3

Actor–partner analyses for adherence

Explanatory variables	Odds ratio (95% CI)			
	3-Day adherence		30-Day adherence	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Potential confounders				
Age (actor)	–	–	–	–
Time on meds (actor)	–	–	–	0.94 (0.91, 0.98) **
Regimen complexity	–	0.88 (0.79, 0.97) **	–	–
Living together	–	–	–	–
Relationship length	–	–	–	–
Couple serostatus	–	–	–	–
Patient				
Depressive symptoms	0.99 (0.96, 1.02)	–	0.98 (0.95, 1.01) †	–
BMQ: General concerns	0.90 (0.85, 0.96) **	0.89 (0.84, 0.95) ***	0.99 (0.93, 1.06)	–
BMQ: Necessity	0.96 (0.88, 1.05)	–	1.02 (0.95, 1.09)	
BMQ: Concerns	0.93 (0.87, 1.01) †	–	0.96 (0.89, 1.03) †	–
Relationship quality				
Satisfaction—CSI	1.04 (0.97, 1.13)	–	1.02 (0.95, 1.11)	–
Satisfaction—Dyadic	1.01 (0.93, 1.09)	–	1.02 (0.95, 1.10)	–
Communication	1.01 (0.95, 1.08)	–	1.04 (1.0004, 1.09) *	1.05 (1.01, 1.10) *
Commitment	1.02 (0.96, 1.07)	–	1.003 (0.96, 1.08)	–
Autonomy	0.99 (0.95, 1.04)	–	1.001 (0.97, 1.04)	–
Equality	1.04 (0.99, 1.09) †	–	1.03 (0.98, 1.08)	–
Intimacy	1.03 (0.99, 1.06) †	–	1.01 (0.98, 1.05)	–
Partner				
Depressive symptoms	0.995 (0.97, 1.02)	–	0.99 (0.96, 1.02)	–
BMQ: General concerns	0.97 (0.92, 1.04)	–	0.93 (0.86, 1.003) †	0.92 (0.86, 0.99) *
BMQ: Necessity	1.12 (1.02, 1.22) *	1.10 (1.003, 1.21) *	1.03 (0.94, 1.12)	–
BMQ: Concerns	0.98 (0.91, 1.05)	–	0.95 (0.89, 1.004) †	–
Relationship quality				
Satisfaction—CSI	0.98 (0.90, 1.07)	–	1.05 (0.99, 1.12) †	–
Satisfaction—Dyadic	1.01 (0.93, 1.09)	–	1.07 (0.998, 1.14) †	–
Communication	0.96 (0.91, 1.01) †	–	1.02 (0.98, 1.06)	–
Commitment	0.998 (0.94, 1.06)	–	1.03 (0.98, 1.08) †	–
Autonomy	1.0001 (0.96, 1.04)	–	1.02 (0.98, 1.06)	–
Equality	0.99 (0.93, 1.04)	–	1.01 (0.96, 1.05)	–
Intimacy	1.007 (0.97, 1.03)	–	0.99 (0.96, 1.02)	–

$N = 294$ for each unadjusted analysis of 3-day adherence and $N = 295$ for each unadjusted analysis of 30-day adherence. $N = 293$ for adjusted 3-day adherence analysis and $N = 294$ for adjusted 30-day adherence analysis due to one participant missing time on medications information

CSI Couple Satisfaction Index

$^{\dagger}p < 0.25$;

$^{*}p < 0.05$;

$^{**}p < 0.01$;

$^{***}p < 0.001$

Table 4

Actor–partner analyses for likelihood of detectable viral load

Explanatory variables	Odds ratio (95% CI)	
	Unadjusted	Adjusted
Potential confounders		
Age (actor)	–	–
Time on meds (actor)	–	–
Regimen complexity	–	–
Living together	–	–
Relationship length	–	–
Couple serostatus	–	1.84 (1.07, 3.18) **
Patient		
Depressive symptoms	1.01 (0.99, 1.04) †	–
BMQ: General concerns	1.005 (0.96, 1.05)	–
BMQ: Necessity	0.97 (0.91, 1.02) †	–
BMQ: Concerns	1.04 (0.98, 1.10) †	–
Relationship quality		
Satisfaction—CSI	1.01 (0.95, 1.07)	–
Satisfaction—Dyadic	0.99 (0.94, 1.04)	–
Communication	0.99 (0.96, 1.02)	–
Commitment	1.02 (0.98, 1.06)	–
Autonomy	0.997 (0.97, 1.02)	–
Equality	1.004 (0.97, 1.04)	–
Intimacy	1.02 (0.996, 1.05) †	–
Partner		
Depressive symptoms	1.01 (0.99, 1.03)	–
BMQ: General concerns	0.99 (0.95, 1.04)	–
BMQ: Necessity	0.97 (0.90, 1.04) †	–
BMQ: Concerns	0.99 (0.94, 1.04)	–
Relationship quality		
Satisfaction—CSI	0.96 (0.91, 1.02) †	–
Satisfaction— Dyadic	0.99 (0.94, 1.04)	–
Communication	0.98 (0.95, 1.01)	–
Commitment	0.95 (0.92, 0.99) **	0.95 (0.92, 0.99) *
Autonomy	1.0004 (0.97, 1.03)	–
Equality	0.995 (0.96, 1.03)	–
Intimacy	1.0005 (0.97, 1.03)	–

N = 291 for each analysis (four participants were missing viral load data: blood draws were declined or unsuccessful due to injection drug use and physical illness/debility)

CSI Couple Satisfaction Index

† $p < 0.25$;

$^{*}p < 0.05$;

$^{**}p < 0.01$