Published in final edited form as:
AIDS Care. 2014 ; 26(6): 702–708. doi:10.1080/09540121.2013.855302.

Alcohol use and HIV disease management: The impact of individual and partner-level alcohol use among HIV-positive men who have sex with men

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Abstract

Alcohol use among HIV-positive (HIV+) individuals is associated with decreased adherence to antiretroviral therapy (ART) and consequently poorer HIV treatment outcomes. This study examined the independent association of individual and partner-level alcohol use with HIV disease management among men who have sex with men (MSM) in primary partnerships. In total, 356 HIV+ MSM and their male primary partners completed a baseline visit for a longitudinal study examining the role of couple-level factors in HIV treatment. The Alcohol Use Disorders Identification Test (AUDIT) was administered to assess the individual and the partner-level alcohol use. Primary outcome variables included: self-reported ART adherence, ART adherence self-efficacy and HIV viral load. Results demonstrated that abstainers, compared to hazardous drinkers, had higher self-efficacy to integrate and persevere in HIV-treatment and a lower odds of having a detectable viral load. Participants with a partner-abstainer, versus a partner-hazardous drinker, had *less* self-efficacy to persevere in HIV-treatment, a lower odds of 100% 3-day adherence and a higher viral load. Together, these findings suggest that assessment and treatment of both the patient's and the patient's primary partner's pattern of alcohol consumption is warranted when attempting to optimize HIV care among MSM.

Despite representing only 4% of the population, men who have sex with men (MSM) represent nearly half of the 1.2 million people living with HIV in the United States (Centers for Disease Control and Prevention (CDC), 2011). Antiretroviral therapy (ART) for the treatment of HIV and AIDS has significantly improved life expectancy however, and the last two years in particular have produced major advances in the prevention and treatment of HIV. Research has revealed that ART, when taken consistently, leads to viral suppression of the HIV-positive patient and can effectively eliminate onward transmission (Hammer, 2011). However, suboptimal adherence is associated with hastened disease progression, ART resistance, morbidity, mortality and risk of secondary transmission via increased viral load (Paterson et al., 2000; Chesney et al., 1999; Garcia de Olalla et al., 2002; Vanhove,

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Shapiro, Winters, Merigan & Blasche, 1996). Additional research on factors that affect adherence to ART is consequently a high priority, and one factor that has emerged as a significant predictor of poor adherence is alcohol use.

Alcohol and ART adherence

Alcohol use is common among MSM and people living with HIV/AIDS in the US. Approximately, 85–95% of urban MSM in large household and venue-based samples report consuming alcohol in the previous six months (Stall et al., 2001; Theide et al., 2003) and 53% of people living with HIV/AIDS in the US report consuming alcohol in the last month (Galvan et al., 2002). The ubiquity and status of alcohol as a socially acceptable and normative form of recreation has prompted concern among HIV-researchers that alcohol is the “forgotten drug” in the HIV epidemic (Fritz, Morojele, & Kalichman, 2010).

Indeed, a growing body of research suggests that alcohol use adversely affects HIV treatment adherence. A recent narrative review found alcohol use disorders (broadly defined) were associated with decreased adherence to ART and poorer HIV treatment outcomes (i.e., CD4 count and HIV viral load; Azar, Springer, Meyer & Altice, 2010). A meta-analysis of 40 studies on the association between alcohol use and ART adherence also found that individuals who reported any alcohol consumption, compared to nonusers or those who drank relatively less, had a significantly lower odds of being classified as “adherent” (odds ratio (OR) = .55; 95% CI = 49, .61; Hendershot, Stoner, Pantalone & Simoni, 2009). Elevations in viral load associated with sub-optimal adherence, combined with alcohol’s well-documented association with an increased risk of engaging in sexual risk behavior (Woolf & Maisto, 2009), significantly increase the likelihood of onward transmission (Hall, Holtgrave, Tang & Rhodes, 2013).

The association between alcohol use and ART adherence may be attributable to the cognitive impairment caused by acute alcohol intoxication (Hendershot et al., 2009). As Steele and Josephs’ (1990) popular alcohol myopia theory suggests, alcohol intoxication restricts one’s attention to salient, immediate information while simultaneously inhibiting attention to more distal or peripheral information. As such, a person under the influence of alcohol who has not taken his HIV medications for the day is unlikely to remember to do so unless an immediate, salient cue penetrates the drinking event. Notably, alcohol myopia theory and its assumptions focus solely on the *individual*’s alcohol consumption and none of the studies in Hendershot et al.’s (2009) meta-analysis or Azar et al.’s (2011) narrative review examined partner-level drinking patterns and their association with ART adherence. This is a considerable gap in the literature given that primary relationship partners are the principal source of social support for male same-sex couples coping with HIV (Haas, 2002).

Primary partnerships and ART adherence

There is a well-developed literature on the beneficial effects of social support on health, particularly immune function (Uchino, 2006). Among people living with HIV/AIDS, social support has been shown to improve ART adherence and HIV treatment-related outcomes (Burgoyne, 2005; Hamilton, Razzano & Martin, 2007; Power et al., 2003; Uchino, 2006). Social support received from a primary relationship partner (as opposed to a family member)

is particularly salient to the promotion of medication adherence among people living with HIV/AIDS (Hamilton et al., 2007). The positive effects of a primary partnership may be attenuated, however, depending on the quality of the relationship. For example, Theodore et al. (2003) observed that low relationship intimacy among HIV-positive gay men taking ART was related to poorer ART adherence. Relationship quality factors (e.g., autonomy, intimacy, satisfaction) were also found to be significant predictors of HIV-treatment related outcomes (e.g., adherence and viral load) in our previous work with same-sex male couples (Johnson, Dilworth, Taylor, Darbes, Comfort & Neilands, 2010).

Collectively, current research indicates that primary relationship partners influence ART adherence and HIV treatment outcomes. This influence may be attributable to the social control, or the ability regulate, influence and constrain behavior, a primary partner exerts (Lewis & Rook, 1999; Wrubel, Stumbo & Johnson, 2008). For example, a primary partner may reduce his drinking in order to fulfill supportive obligations and model health behavior to his HIV-positive partner (indirect control strategy) or actively attempt to influence the HIV-positive partner by reminding him to take his medications (direct control strategy). A primary partner's alcohol use may therefore diminish his ability to effectively model or influence health behaviors that affect ART adherence. However no research, to our knowledge, has examined the role of primary partner alcohol use on HIV treatment-related outcomes.

The present study investigated the influence of individual and partner-level alcohol consumption among 356 HIV+ MSM on ART who reported having a primary relationship partner. It was hypothesized that HIV+ men on ART who were categorized as hazardous drinkers, and HIV+ men with partners who were categorized as hazardous drinkers (compared with men categorized as abstainers or moderate drinkers) would have poorer adherence to ART and higher viral load.

Method

Overview

These findings are from the baseline visit of the DUO study, a longitudinal cohort study examining the role of couple-level factors in HIV treatment among HIV+ MSM with primary partners (Johnson et al., 2011). Couples were recruited from the San Francisco Bay area using flyers placed at community-based organizations and participant referrals (Johnson et al, 2011). Inclusion criteria were as follows: (1) 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 (i.e., currently in a "primary" 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

As described in Johnson et al. (2011) couples completed interviews separately, in private rooms, with a combination of Computer Assisted Personal Interviewing (CAPI) and Audio

Computer Assisted Self Interviewing (ACASI). All sensitive items, including relationship dynamics, alcohol use, and medication adherence, were completed using ACASI. Thus, the key variables were collected without the presence of the partner or interviewer, which mitigates the potential effects of social desirability. Blood draws were conducted with HIV-positive partners during the assessment visit. Participants were paid $50 USD each for completing the survey and an additional $10 USD for providing a blood sample. All procedures were reviewed and approved by the Committee on Human Research, the Institutional Review Board (IRB) at the University of California, San Francisco.

Measures

Demographic and individual difference variables—We included: participant age, race, ethnicity, educational level, length of time since HIV-positive serostatus was first known, length of time on ART, length of current relationship and couples serostatus.

Relationship quality variables—Several measures of relationship quality were included for use as covariates in the multivariate analyses. The 4-item Couples Satisfaction Index (Funk & Rogge, 2007) measured relationship satisfaction ($\alpha = 0.93$). An adapted set of scales from Kurdek's (1995) work with couples was used to assess relationship commitment (four items; $\alpha = 0.96$), intimacy (six items; $\alpha = 0.76$) and autonomy (five items; $\alpha = 0.74$). Finally, relationship communication was assessed with a 5-item constructive communication subscale created from the 11-item Communications Patterns Questionnaire (Christensen & Shenk, 1991; $\alpha = 0.89$).

Alcohol use—Alcohol use was assessed with the 10-item Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente & Grant, 1993). The AUDIT was designed to identify individuals whose alcohol use places them at risk for the development of an alcohol use disorder. Each participant's score was obtained by adding the 10-items for a total score ranging from 0–40. Participants were characterized as either "abstainers" (AUDIT = 0), "non-hazardous drinkers" (AUDIT score = 1–7) or "hazardous drinkers" (AUDIT ≥ 8; Babor, Biddle-Higgins, Saunders & Monteiro, 2001).

Adherence self-efficacy—The HIV-adherence self-efficacy scale (ASES) scale was used to assess confidence in one's ability to comply with an HIV treatment plan (Johnson et al., 2007). The ASES includes two subscales that measure confidence to successfully *integrate* ART into one's daily routine (ASES-integration; $\alpha = 0.88$) and confidence to *persevere* in ART treatment (ASES-perseverance; $\alpha = 0.69$).

Adherence to antiretroviral medications—Adherence was assessed using the adherence measure developed by the AIDS Clinical Trials Group (ACTG; Chesney et al., 2000), which provides detailed information about adherence over the prior 3 days and the visual analog scale (VAS) developed by Walsh, Pozniak, Nelson, Mandalia and Gizzard (2002) to assess 30-day adherence along a continuum anchored by "0" to "100%." 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. Since self-report measures often over-estimate adherence we chose to compare those who endorsed any non-adherence to those who

reported perfect adherence. In these analyses 3-day and 30-day adherence was categorized into a binary outcome (0 = less than perfect adherence; 1 = 100% adherence).

HIV viral load—Viral load testing was performed using the COBAS_AmpliPrep/ COBAS_TaqMan_ HIV test kit (Roche Molecular Systems, Inc.), which has a threshold for undetectability at 50 copies/ml. We characterized viral load as both a dichotomous (detectable versus undetectable) and a continuous (log10 viral load) variable.

Data Analysis

In order to investigate the association of the individual's and the partner's alcohol use on the adherence and treatment-related outcomes of each participant, we used *patient-partner analyses* (Johnson et al., 2011). Briefly, generalized estimating equations (GEE) were used to regress the participant's (i.e., *the patient*) AUDIT score categorization on his own adherence and treatment related outcomes (i.e., *the patient effects*) in addition to the participant's primary *partner*'s AUDIT score categorization on the participant's adherence and treatment-related outcomes (i.e., *the partner effect*; Kenny, Kashy & Cook, 2006). This type of analysis properly accounts for the fact that outcome scores are correlated within couples and provides corrected standard errors and test statistics via the use of an exchangeable working correlation matrix and robust empirical standard errors. To make results more interpretable for adherence self-efficacy, the ASES integration and perseverance scores were rescaled such that AUDIT categorizations were associated with a standard deviation change in the ASES scores, resulting in a standardized coefficient, β. SAS PROC GENMOD was used to obtain the model results reported below.

Based on our previous research on adherence among same-sex male couples (Johnson et al., 2011), we controlled for the following potential confounders in the multivariate model: length of time on ART, couple serostatus (seroconcordant or serdiscordant), relationship length, and the following relationship quality indicators: the patient's autonomy, intimacy, and communication, and his partner's satisfaction and commitment.

Results

Sample characteristics

The sample included 356 HIV+ MSM with primary partners who were on ART at the time of the study interview and contributed samples for HIV viral load testing. The sample had a mean age of 45.5 (SD = 10.0), was mostly White (60.1%), had been on ART approximately 9.5 years and had been in a relationship for an average of 79 months (median = 51.0, interquartile range = 100.8, Q1 = 18, Q3 = 118.8). Approximately 74% of the patients in the sample reported regular alcohol consumption with most screening as non-hazardous drinkers (58.4%), followed by abstainers (26.1%), and hazardous drinkers (15.4%).

Patient-partner analyses

Patient effects—In general, patients who screened as abstainers or non-hazardous drinkers reported higher adherence to ART, had higher self-efficacy for adherence, and had a lower odds of detectable viral load compared with hazardous drinkers (see Table 1).

Abstainers, compared with hazardous drinkers, had significantly higher self-efficacy to integrate (β = .59; 95% CI = .22, .96) and persevere (β = .47; 95% CI = .09, .85) in HIV-treatment, a lower odds of having a detectable viral load (AOR = .46; 95% CI =.22, .97), and a marginally significant association with viral load (AOR = 2.64; 95% CI = .91, 7.68). Abstainers, compared with non-hazardous drinkers, had a 2.58 greater odds of 100% 3-day adherence (95% CI = 1.17, 5.68), but were not distinguishable from non-hazardous drinkers on any other outcome. Non-hazardous drinkers, compared with hazardous drinkers, had a higher odds of 100% 30-day adherence (AOR = 2.83; 95% CI = 1.14, 6.97) and higher self-efficacy to integrate (β = .51; 95% CI = .17, .85) and persevere (β = .50; 95% CI = .18, .82) in HIV treatment. There were no significant patient effects for log10 viral load.

Partner effects—Patients with a partner-abstainer, compared with patients with a partner-hazardous drinker, had a significantly *lower odds* of 100% three-day adherence (AOR = .05; 95% CI = .01, .51), *less* self-efficacy to persevere in HIV-treatment (β = −.47; 95% CI = −.82, −.13), and a *higher* log10 viral load (β = .43; 95% CI = .06, .78). Similarly, patients with a partner- non-hazardous drinker, compared with patients with a partner-hazardous drinker, had a significantly higher odds of having a detectable viral load (AOR = 1.88; 95% CI = 1.03, 3.45) and less self-efficacy to persevere in HIV-treatment (β = −.30; 95% CI = −.58, −.02). There were no significant partner effects for self-efficacy to integrate HIV treatment or 30-day adherence. Partner-abstainers were not distinguishable from partner-non-hazardous drinkers on any HIV-related outcome.

Discussion

There is a large body of research on the association between individual-level alcohol consumption and adherence to ART (Azar et al., 2010; Hendershot et al., 2009). Our work replicates and extends these findings by demonstrating the influence of both individual and primary partner-level patterns of alcohol consumption on HIV treatment-related outcomes among MSM. As hypothesized, we found that hazardous drinkers were significantly less likely to be adherent to ART, had less self-efficacy to integrate ART into their daily routine and persevere in HIV treatment, and had a higher odds of a detectable viral load compared with abstainers and moderate drinkers. Notably, abstainers were not significantly different from non-hazardous drinkers on almost all of the outcome variables, indicating that heavy, rather than moderate, alcohol use is perhaps most relevant for interventions attempting to optimize the effectiveness of HIV treatment.

Our unique contribution to the literature is our finding that HIV+ MSM with primary partner-abstainers were significantly less likely to be 100% adherent to ART, reported less self-efficacy to persevere in HIV treatment and had a higher viral load compared to MSM with primary partners who were hazardous drinkers. The counterintuitive findings may be related to discrepant alcohol consumption within the couple. Only 12% of the couples in our analyses were concordant for abstinence, which means that in a majority of the couples, partner-abstainers were paired with alcohol-consuming HIV-positive men. Interactive toxicity beliefs (i.e., the belief that alcohol use negatively affects ART and thus the two should not be mixed) are prevalent among people living with HIV/AIDS and particularly common among nondrinkers (Kalichman et al., 2009). These beliefs are associated with

significantly poorer ART adherence and missed doses on drinking days (Kalichman et al., 2013). Given that social control strategies are more likely to be experienced as intense and distressing when targeted towards health compromising behaviors such as alcohol use (Lewis and Rook, 1999), it is possible that the abstaining partners' beliefs about the toxicity of alcohol use and ART inadvertently led to poorer HIV-treatment related outcomes. Future research should investigate how a partner's interactive toxicity beliefs and use of various social control strategies influence a patient's adherence behavior, particularly among male same sex couples where one partner abstains from alcohol use.

It is noteworthy, in the findings that the relationship between alcohol and HIV-treatment outcomes was at times inconsistent between self-reported adherence and therapeutic impact (i.e., viral load). This may be partially attributable to the social desirability and recall biases inherent to self-report data, which would result in significant findings for viral load, but marginal or insignificant findings for adherence (i.e., patient-abstainers vs. patient hazardous drinkers). In the other direction, the dichotimization of adherence to 100% vs.<100%, while a common practice, may have allowed for some participants to be misclassified as "non-adherent" despite only having missed one dose in the last 30 days, a level of non adherence unlikely to influence viral load. Providers may wish to use a combined behavioral and biomedical approach to adherence assessment when estimating the impact of a patient's alcohol use on his or her HIV treatment outcomes.

Additional limitations should be considered in the interpretation of our study findings. First, the use of a cross-sectional design significantly restricts our ability to draw conclusions about the temporality and directionality of the association between alcohol use and HIV treatment-related outcomes. It is unclear from these data whether alcohol use causes poor HIV treatment-related outcomes or if poor adherence and disease management prompts alcohol use. Similarly, these data do not permit any conclusions about the temporal co-occurrence of acute alcohol intoxication and failure to adhere to HIV medications. Following couples over time and collecting data on the amount of alcohol consumed by both the patient and the partner and adherence to HIV medications at frequent intervals would allow for greater specificity in determining if and how alcohol use is temporally linked with non-adherence at the individual and the couple-level. Finally, the representativeness of our sample of MSM should be considered when generalizing the findings from our study. While the level of alcohol use in our sample is consistent with population-based samples of urban MSM from both San Francisco and other major US cities (Stall et al., 2001), other characteristics of this convenience sample such as age, race and relationship length, may be less representative of the broader population of MSM.

These limitations notwithstanding, our findings provide the first available evidence on the importance of partner-level alcohol use in the management and treatment of HIV among MSM. HIV-care providers may wish to consider the assessment of both the patient's and, if applicable, the patient's primary partner's pattern of alcohol consumption when attempting to optimize HIV-care and enhance treatment outcomes.

Acknowledgments

This work was supported by an R24 from the National Institute of Nursing Research (NINR R34R01NR010187) and a T32 from the National Institute of Mental Health (NIMH T3219105-22). We would also like to thank the men who participated in the study and the tireless efforts of the study interviewers and recruiters.

References

Azar MM, Springer SA, Meyer JP, Altice FL. A systematic review of the impact of alcohol use disorders on HIV treatment outcomes, adherence to antiretroviral therapy and health care utilization. Drug and Alcohol Dependence. 2010; 112(3):178–193.10.1016/j.drugalcdep.2010.06.014 [PubMed: 20705402]

Babor, TF.; Biddle-Higgins, JC.; Saunders, JB.; Monteiro, MG. AUDIT: The Alcohol Use Disorders Identification Test. Guidelines for use in primary health care. Geneva, Switzerland: World Health Organization; 2001.

Burgoyne RW. Exploring direction of causation between social support and clinical outcomes for HIV-positive adults in the context of highly active antiretroviral therapy. AIDS Care. 2005; 17(1): 111–124.10.1080/09540120412331305179 [PubMed: 15832838]

Centers for Disease Control and Prevention (CDC). CDC Fact Sheet: HIV and AIDS among Gay and Bisexual Men. 2011. Retrieved 4/2/2012 from http://www.cdc.gov/nchhstp/newsroom/docs/fastfacts-msm-final508comp.pdf

Chesney MA, Ickovics J, Hecht FM, Sikipa G, Rabkin J. Adherence: a necessity for successful HIV combination therapy. AIDS. 1999; 13(Suppl A 3):S271–278. [PubMed: 10885784]

Chesney MA, Ickovics JR, Chambers DB, Gifford AL, Neidig J, Zwickl B, Wu AW. Self-reported adherence to antiretroviral medications among participants in HIV clinical trials: the AACTG adherence instruments. Patient Care Committee & Adherence Working Group of the Outcomes Committee of the Adult AIDS Clinical Trials Group (AACTG). AIDS Care. 2000; 2(3):255–66.10.1080/09540120050042891 [PubMed: 10928201]

Christensen A, Shenk JL. Communication, conflict, and psychological distance in nondistressed, clinic, and divorcing couples. Journal of Consulting and Clinical Psychology. 1991; 59(3):458–463.10.1037/0022-006X.59.3.458 [PubMed: 2071731]

Fritz K, Morojele N, Kalichman S. Alcohol: the forgotten drug in HIV/AIDS. The Lancet. 2010; 376(9739):398–400.10.1016/S0140-6736(10)60884-7

Funk JL, Rogge RD. Testing the ruler with item response theory: increasing precision of measurement for relationship satisfaction with the Couples Satisfaction Index. Journal of Family Psychology. 1997; 21(4):572–583.10.1037/0893-3200.21.4.572 [PubMed: 18179329]

Galvan FH, Bing EG, Fleishman JA, London AS, Caetano R, Burnam MA, Shapiro M. The prevalence of alcohol consumption and heavy drinking among people with HIV in the United States: results from the HIV Cost and Services Utilization Study. Journal of Studies on Alcohol. 2002; 63:179–186. [PubMed: 12033694]

Garcia de Olalla P, Knobel H, Carmona A, Guelar A, Lopez-Colomes JL, Cayla JA. Impact of adherence and highly active antiretroviral therapy on survival in HIV-infected patients. Journal of Acquired Immune Deficiency Syndromes. 2002; 30(1):105–110. [PubMed: 12048370]

Haas SM. Social support as relationship maintenance in gay male couples coping with HIV or AIDS. Journal of Social & Personal Relationships. 2002; 19:87–111.10.1177/0265407502191005

Hahn JA, Samet JH. Alcohol and HIV disease progression: Weighing the evidence. Current HIV/AIDS Reports. 2010; 7(4):226–233.10.1007/s11904-010-0060-6 [PubMed: 20814765]

Hall HI, Holtgrave DR, Tang T, Rhodes P. HIV transmission in the United States: Considerations of viral load, risk behavior, and health disparities. AIDS and Behavior. 2013 Advanced online publication. 10.1007/s10461-013-0426-z

Hamilton MM, Razzano LA, Martin NB. The relationship between type and quality of social support and HIV medication adherence. Journal of HIV/AIDS & Social Services. 2007; 6(1/2):39–63.10.1300/J187v06n01_04

Hammer SM. Antiretroviral treatment as prevention. New England Journal of Medicine. 2011; 365:561–562.10.1056/NEJMe1107487 [PubMed: 21767102]

Hendershot CS, Stoner SA, Pantalone DW, Simoni JM. Alcohol use and antiretroviral adherence: Review and meta-analysis. Journal of Acquired Immune Deficiency Syndromes. 2009; 52(2):180–206.10.1097/QAI.0b013e3181b18b6e [PubMed: 19668086]

Johnson MO, Dilworth S, Taylor J, Darbes L, Comfort M, Neilands T. Primary Relationships, HIV Treatment Adherence, and Virologic Control. AIDS and Behavior. 2010:1–11.10.1007/s10461-011-0021-0 [PubMed: 18843530]

Johnson MO, Neilands TB, Dilworth S, Morin SF, Remien RH, Chesney MA. The role of self efficacy in HIV treatment adherence: Validation of the HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES). Journal of Behavioral Medicine. 2007; 30:359–70.10.1007/s10865-007-9118-3 [PubMed: 17588200]

Kalichman SC, Amaral CM, White D, Swetsze C, Pope H, Kalichman MO, Eaton L. Prevalence and clinical implications of interactive toxicity beliefs regarding mixing alcohol and antiretroviral therapies among people living with HIV/AIDS. AIDS Patient Care and STDs. 2009; 23(6):449–454.10.1089/apc.2008.0184 [PubMed: 19413503]

Kalichman SC, Grebler T, Amaral CM, McNerey M, White D, Kalichman MO, Cherry C, Eaton L. Intentional non-adherence to medications among HIV positive alcohol drinkers: Prospective study of interactive toxicity beliefs. Journal of General Internal Medicine. 2013; 28(3):399–405.10.1007/s11606-012-2231 [PubMed: 23065532]

Kenny, DA.; Kashy, DA.; Cook, WL. Dyadic Data Analysis. NY: Guilford; 2006.

Kurdek LA. Assessing multiple determinants of relationship commitment in cohabiting gay, cohabiting lesbian, dating heterosexual, and married heterosexual couples. Family Relations: Interdisciplinary Journal of Applied Family Studies. 1995; 44(3):261–266.

Lewis MA, Rook KS. Social control in personal relationships: Impact on health behaviors and psychological distress. Health Psychology. 1999; 18(1):63–71. [PubMed: 9925047]

Paterson DL, Swindells S, Mohr J, Brester M, Vergis EN, Squier C, Sing N. Adherence to protease inhibitor therapy and outcomes in patients with HIV infection. Annals of Internal Medicine. 2000; 133(1):21–30.10.7326/0003-4819-133-1-200007040-00004 [PubMed: 10877736]

Power R, Koopman C, Volk J, Israelski DM, Stone L, Chesney MA, Spiegel D. Social support, substance use, and denial in relationship to antiretroviral treatment adherence among HIV-infected persons. AIDS Patient Care STDS. 2003; 17(5):245–252.10.1089/108729103321655890 [PubMed: 12816618]

Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction. 1993; 88(6):791–804.10.1111/j.1360-0443.1993.tb02093.x [PubMed: 8329970]

Stall R, Paul JP, Greenwodd G, Pollack LM, Bein E, Crosby GM, Catania JA. Alcohol use, drug use and alcohol-related problems among men who have sex with men: the Urban Men's Health Study. Addiction. 2001; 96:1589–1601.10.1046/j.1360-0443.2001.961115896.x [PubMed: 11784456]

Steele CM, Josephs RA. Alcohol myopia: Its prized and dangerous effects. American Psychologist. 1990; 45(8):921–933. [PubMed: 2221564]

Theide H, Valleroy LA, MacKellar MA, Celentano DD, Ford WL, Hagan H, Torian LV. Regional patterns and correlates of substance use among men who have sex with men in 7 US urban areas. American Journal of Public Health. 2003; 93(11):1915–1921.10.2105/AJPH.93.11.1915 [PubMed: 14600066]

Theodore, P.; Duran, R.; Antoni, MH.; Fernandez, I.; Schneiderman, N. Intimacy and medication adherence among HIV-positive men in primary relationships. Salt Lake City: Society of Behavioral Medicine; 2003.

Uchino BN. Social support and health: A review of physiological processes potentially underlying links to disease outcomes. Journal of Behavioral Medicine. 2006; 29(4):377–387.10.1007/s10865-006-9056-5 [PubMed: 16758315]

Vanhove GF, Schapiro JM, Winters MA, Merigan TC, Blaschke TF. Patient compliance and drug failure in protease inhibitor monotherapy. Journal of the American Medical Association. 1996; 276(24):1955–1956.10.1001/jama.1996.03540240033024 [PubMed: 8971062]

Walsh JC, Pozniak AL, Nelson MR, Mandalia S, Gazzard BG. Virologic rebound on HAART in the context of low treatment adherence is associated with a low prevalence of antiretroviral drug resistance. Journal of Acquired Immune Deficiency Syndrome. 2002; 30:278–287.10.1097/01.QAI.0000018000.56638.4

Woolf SE, Maisto SA. Alcohol use and risk of HIV infection among men who have sex with men. AIDS and Behavior. 2009; 13(4):757–782.10.1007/s10461-007-9354-0 [PubMed: 18236149]

Wrubel J, Stumbo S, Johnson MO. Antiretroviral medication support practices among partners of men who have sex with men: A qualitative study. AIDS Patient Care & STDS. 2008; 22(11):851–858.10.1089/apc.2008.0037 [PubMed: 19025479]

Table 1

Patient-partner analyses for the association between alcohol use category and HIV-related outcomes

Explanatory Variables	3-day adherence		30-day adherence		ASES- Integration		ASES- Perseverance		Detectable Viral Load		Log 10 Viral load	
	AOR	95% CI	AOR	95% CI	β	95% CI	β	95% CI	AOR	95% CI	*B*	95% CI
Patient's AUDIT												
Abstainer vs. non-hazardous	**2.58***	1.17, 5.68	.93	.48, 1.82	.08	−.13, .29	−.03	−.28, .22	.58†	.33, 1.02	−.01	−.27, .25
Abstainer vs. hazardous	2.16	.62, 7.54	2.64†	.91, 7.68	**.59****	.22, .96	**.47***	.09, .85	**.46***	.22, .97	−.26	−.68, .15
Non-hazardous vs. hazardous	.84	.28, 2.53	**2.83***	1.14,6.97	**.51****	.17, .85	**.50****	.18, .82	.78	.44, 1.46	−.25	−.61, .10
Omnibus effect (χ^2)	**6.26***		**6.32***		**8.84***		**8.36***		4.83†		1.99	
Partner's AUDIT												
Abstainer vs. non-hazardous	.50†	.25, 1.01	.97	.50, 1.89	−.09	−.32, .15	−.17	−.43, .10	1.17	.66, 2.07	.19	−.08, .47
Abstainer vs. hazardous	**.05***	.01, .51	.98	.38, 2.24	−.33†	−.69, .02	**−.47****	−.82, −.13	2.19†	1.05, 4.57	**.43***	.06, .78
Non-hazardous vs. hazardous	.10†	.01, 1.01	.95	.45, 2.03	−.25	−.55, .05	**−.30***	−.58, −.02	**1.88***	1.03, 3.45	.23	−.08, .54
Omnibus effect (χ^2)	**14.78****		.03		3.29		**6.74***		5.12†		4.91†	

Note. AOR = adjusted odds ratio; β = standardized beta; AUDIT = Alcohol use disorders identification test; CI = confidence interval; ASES = Adherence self-efficacy scale, ART = antiretroviral therapy, "abstainers" (AUDIT = 0), "non-hazardous drinkers" (AUDIT score = 1–7) and "hazardous drinkers" (AUDIT score ≥ 8). Analyses adjusted for time on ART, couple serostatus, and relationship satisfaction. Each omnibus χ^2 test is evaluated at 2 degrees of freedom.

†p < .10,

*p < .05,

**p < .01