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Prospective Predictors of Unprotected Anal Intercourse among HIV-Seropositive Men Who Have Sex with Men Initiating Antiretroviral Therapy

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Abstract

Contemporary HIV prevention efforts are increasingly focused on those already living with HIV/AIDS (i.e., “prevention with positives”). Key to these initiatives is research identifying the most risky behavioral targets. Using a longitudinal design, we examined socio-demographic and psychosocial factors that prospectively predicted unprotected anal intercourse (UAI) in a sample of 134 HIV-seropositive men who have sex with men (MSM) initiating, changing, or re-starting an antiretroviral therapy (ARV) regimen as part of a behavioral intervention study. Computer-based questionnaires were given at baseline and 6 months. In a sequential logistic regression, baseline measures of UAI (Step 1), socio-demographic factors such as Latino ethnicity (Step 2), and psychosocial factors such as crystal methamphetamine use, greater life stress, and lower trait anxiety (Step 3) were predictors of UAI at 6 months. Problem drinking was not a significant predictor. Prevention efforts among MSM living with HIV/AIDS might focus on multiple psychosocial targets, like decreasing their crystal methamphetamine use and teaching coping skills to deal with life stress.

Keywords

HIV/AIDS; transmission risk; positive prevention; unprotected sex; men who have sex with men (MSM)

INTRODUCTION

Men who have sex with men (MSM) in the United States (U.S.) have been disproportionately affected by the HIV/AIDS epidemic. Although only 3% of the U.S. adult population is estimated to be MSM (1,2), in 2010, this group accounted for approximately 63% of incident HIV infections and 52% of all people living with HIV/AIDS (3,4). There are also racial disparities in the U.S. HIV/AIDS epidemic. Black MSM have been particularly affected by HIV and have the highest HIV prevalence (28%) (5). Unprotected anal

intercourse (UAI) appears to be the primary mode of HIV transmission among U.S. MSM (6). A meta-analysis estimated that 43% of HIV-seropositive MSM continue to engage in UAI, 26% with partners of unknown or HIV-seronegative status (7). Additionally, while HIV-seropositive MSM recruited from medical clinics were slightly less likely to engage in UAI (39%) compared to men recruited from the community (49%; 7), they still reported a high level of risk-taking—placing others at risk for acquiring HIV, themselves at risk for contracting other sexually transmitted infections (STIs), weakening their already compromised immune systems (8), and increasing the potential for superinfection with multiple strains of HIV (9).

Recent calls for behavioral HIV prevention efforts suggest targeting the behavior of people living with HIV (termed “secondary prevention” in the literature) to reduce their engagement in HIV transmission risk behaviors (10,11). Reviews have found that some of these “positive prevention” interventions have been successful and, in some cases, more successful than primary prevention efforts at helping to attenuate the spread of HIV (10). Experts have called for secondary prevention efforts that involve both behavioral and biological components and target elements that affect both HIV risk behavior and infectivity (10), including psychosocial factors. Mental health considerations have been suggested as an important focus for positive prevention (11-14) since MSM generally, and HIV-seropositive MSM specifically, are disproportionately affected by mental health and psychosocial problems (11,14,15). Researchers have suggested that these problems may interfere with the uptake of HIV behavioral interventions and that combination prevention interventions are needed that address interacting psychological and behavioral mechanisms that increase HIV risk (15).

Over the years, there has been some debate about the impact of psychosocial factors—especially psychological stress—on sexual risk behaviors among HIV-seropositive MSM. In an extensive literature review published in 2002, Crepez and Marks found little evidence that psychological distress was related to sexual risk behaviors in HIV-seropositive men and women (16). However, since then, multiple studies have found support for those such associations, especially among HIV-seropositive MSM (15,17-19). Recently, there has been a growing literature indicating that mental health issues (i.e., childhood sexual abuse, posttraumatic stress disorder [PTSD], anxiety disorders, depression, polysubstance use, alcohol abuse) frequently co-occur among MSM and may act additively to increase sexual risk taking (26, 27). Another line of recent research has found that continuous or dimensional measures of psychological distress (vs. dichotomous measures yoked to threshold diagnostic criteria) were directly related to increased sexual risk-taking among MSM (20,22). This work suggests that identifying within-person variability in negative affect using more dimensional measures of mental health, as opposed to formal psychiatric diagnoses, may allow for more accurate, proximal prediction of risk in longitudinal studies.

Since the advent of combination antiretroviral medications (ARVs), there has been speculation that ARV initiation may be related to subsequent increases in sexual risk-taking among MSM (23). While being treated with ARVs has not in itself been associated with increased UAI among HIV-seropositive MSM (7,24), there is evidence that non-adherent HIV-seropositive individuals report increased sexual risk-taking compared to adherent individuals (25-29). This finding is likely due to common predictors of non-adherence and sexual risk-taking, including alcohol and other substance abuse, as well as psychological stress (28-32). These links are especially robust among HIV-seropositive MSM who use crystal methamphetamine (meth; 33). While there have been a few longitudinal studies reporting on factors that impact sexual risk-taking and adherence among HIV-seropositive MSM (e.g., 34-37), most research in this area has utilized cross-sectional methodologies and, thus, is unable to establish causality or even temporal precedence. Continued

longitudinal work in this area is clearly needed to more thoroughly explore the socio-demographic and psychological factors that predict sexual risk-taking among MSM in care.

In the present study, we were interested in informing positive prevention strategies by studying HIV-seropositive MSM who were initiating, changing, or re-starting ARV regimens. Using baseline and follow-up data collected in a prior randomized controlled trial (RCT), we conducted a longitudinal secondary data analysis to: (1) determine if HIV-seropositive MSM in care are engaging in UAI and (2) establish baseline demographic or psychological factors that predict later sexual risk-taking among the participants. Our study builds upon previous work by incorporating a longitudinal design and dimensional measures of psychological constructs as well as focusing on a high-risk population that is accessible for potential intervention efforts.

METHODS

Procedure

The data used in this analysis were collected as part of an NIMH-funded RCT that compared peer support (in-person group & telephone individual), pager reminders, and standard care to improve ARV adherence (38). Intervention aims were related to adherence only and did not directly target mental health problems, sexual risk behavior, or engagement with care.

Recruitment was conducted in a public, university-affiliated, outpatient HIV primary care clinic in Seattle, Washington, USA. Eligible participants were initiating ARVs for the first time, changing, or re-starting ARV regimens; were 18 years of age or older; did not have a dementia diagnosis or psychotic disorder; and lived within range of the pagers (i.e., the Seattle Metro area). Participants in the intervention trial ($N = 224$) were randomly assigned to study arm. Computer-assisted self-interviews (CASI) were administered at baseline and then post-enrollment at 2 weeks and 3, 6, and 9 months. In planning our analyses of this dataset, we replicated the methods of other authors who—using appropriate controls—examined data from intervention studies across all study arms as observational cohort data (39).

Participants

The analytic sample included the 134 men with baseline reports of sexual contact with men at any time in their life and self-identification as either gay or bisexual. Of these men, 54% self-identified as White, 23% as Black or African American, 11% as Latino/Hispanic, and 12% as other or mixed race. The mean age was 39 years (*standard deviation* [*SD*] = 8; range 19-60) and the majority of participants were unemployed (75%), with a median monthly income of \$1015 (range 553-1477). The sample was fairly well educated: 78% had a high school degree or GED and 11% had a college degree. With respect to ARV experience, 40% were ARV naïve at baseline and 60% were changing or re-restating an ARV regimen. The mean length of time since diagnosis was 8 years (*SD* = 7).

Measures

Assessed demographics were age; race/ethnicity (coded as Black, Latino, White, or Other); education level (coded as less than High School [HS] versus HS or greater); number of sexual partners (coded as 0, 1, or 2 or more); and years diagnosed with HIV. All variables were based on baseline assessment data except for sexual behavior, which was based on measures administered both at baseline and at the 6-month assessment visits.

Sexual behavior—Unprotected anal intercourse (UAI) with men was assessed using the HIV Transmission Risk Behaviors Measure (40). It assesses the frequency of high-risk

sexual behavior in the past six months with male partners who were HIV-seropositive, HIV-negative, or whose serostatus was unknown to the respondent. Items (e.g., “In the past six months, with your male HIV-seropositive sex partner(s), on average how often did you have unprotected anal sex?”) are scored from 0 = *never* to 6 = *about daily*. Due to small cell sizes with negative and unknown status partners, a dichotomous indicator of UAI was computed, reflecting any unprotected receptive or insertive anal intercourse with any man in the preceding 6 months.

Alcohol use—Problematic alcohol use in the past year was measured using the 10-item Alcohol Use Disorder Identification Test (AUDIT; 41). The AUDIT is more sensitive for hazardous or harmful drinking patterns and, therefore, is better suited than other measures of alcohol use disorders to identify a wider spectrum of alcohol problems (42). Three items assess alcohol consumption (e.g., “How often do you have a drink containing alcohol?”); three assess drinking behavior (e.g., “How often did you find that you were not able to stop drinking once you had started?”); and four assess alcohol-related problems and adverse reactions (e.g., “How often during the last year have you been unable to remember what happened the night before because you had been drinking?”). Each item included 5 response options scored from 0 = *never* to 4 = *almost daily*. Overall scores ranged from 0 to 40 with higher scores indicating more problematic alcohol use. In development and validation, 92% of those with hazardous or harmful alcohol use (judged by World Health Organization and the ICD-10 system) scored at least 8 points on the AUDIT scale. We used the customary cut-off of 8 or more as indicative of a strong likelihood of hazardous alcohol consumption (41). In this study, Cronbach’s alpha was 0.85.

Meth use—We used one item on the average weekly frequency of meth use in the past year from the Daily Drug Taking Questionnaire (DDTQ; 43), with response options ranging from 0 = *never* to 8 = *7 days per week*. A dichotomous indicator of any past year meth use was computed.

Perceived stress—Perceived stress was measured using the 14-item Perceived Stress Scale (PSS; (44). Respondents reported the degree to which their lives during the past 30 days were unpredictable (e.g., “How often have you been upset because of something that happened unexpectedly?”); uncontrollable (e.g., “How often have you been able to control irritations in your life?”); or overloaded (e.g., “How often have you felt that difficulties were piling up so high you could not overcome them?”). The response options ranged from 0 = *never* through 4 = *very often* and were averaged to form an index of perceived stress from 0 to 4, with higher scores reflecting greater stress. The PSS has well-established internal and test-retest reliability (44). In the current study, Cronbach’s alpha was .86.

Trait anxiety—Trait anxiety was measured using the State-Trait Anxiety Inventory for Adults (STAI, Form Y; 45). The 10-item trait anxiety subscale assesses the degree to which respondents experience a general feeling of apprehension, tension, nervousness, or worry. The items (e.g., “I worry too much over something that really does not matter”) are scored from 1 = *almost never* to 4 = *almost always*. Three items are worded to capture the absence of anxiety (e.g., “I feel calm”) and are reverse scored. Items were averaged to form an index of trait anxiety ranging from 1 to 4, with higher scores reflecting more anxiety. The trait anxiety subscale has demonstrated good internal consistency (median α = .90) and test-retest reliability (r = 0.73-0.86) (45). In the current study, Cronbach’s alpha was .89.

Statistical Methods

To assess for differences between participants with complete self-report data and those who were missing data on one or more variables, χ^2 tests and one-way ANOVAs were conducted

on categorical and continuous socio-demographic characteristics, respectively. A multiple imputation using chained equations approach was utilized to address missing data (46). First, ten complete datasets were generated by imputing the missing values in the original dataset. All subsequent analyses were replicated across each of the imputed datasets, with the final results calculated as a pooled average of the ten analyses using Rubin's rules (47).

For descriptive purposes, we conducted bivariate correlations, means, and standard deviations of the socio-demographic, psychosocial, and sexual behavior factors. We first conducted separate analyses of each potential risk factor to understand its effect without the complication of collinearity with other risk factors. In these models, 6-month UAI was regressed on baseline UAI and the socio-demographic or psychosocial predictor. Intervention condition was not associated with prospective change in UAI and was not included in further models in order to maximize statistical power.

A sequential logistic regression analysis was then conducted to assess the multivariate association between (1) socio-demographic variables and UAI and (2) psychosocial factors and UAI, controlling for socio-demographics. The objective of the regression analysis was to assess whether baseline socio-demographic and psychosocial factors would prospectively predict 6-month UAI, after controlling for initial levels of UAI. In step 1, baseline UAI (predictor 1) was entered into the model to establish a prospective analysis. In step 2, baseline age (2), race/ethnicity (3), education level (4), number of sexual partners (5), and number years diagnosed with HIV (6) were entered to account for socio-demographic factors in sexual behavior. In step 3, alcohol use (7), meth use (8), perceived stress (9), and trait anxiety (10) were entered to assess the effect of baseline psychosocial factors not explained by socio-demographic factors. We utilize $p < .05$ as our threshold of statistical significance and also report marginally significant results of $p < .10$ to evaluate trend level findings.

RESULTS

Missing data and attrition

Of the 134 men in the analytic sample, only 6 (4%) were missing any socio-demographic or psychosocial data, while 22 (16%) were missing outcome data. No significant differences were found between those with complete (80%) versus missing data on one or more variables on age, race/ethnicity, education, number of sexual partners, and years diagnosed with HIV, suggesting that missing data was not likely to have biased the statistical analyses. Of the 134 men in the analytic sample at baseline, 117 (87%) were retained at the 6-month follow-up. There were no statistically significant baseline socio-demographic or psychosocial differences between participants who were missing versus not missing UAI outcome data.

Descriptive statistics

Bivariate correlations, means, and standard deviations of the socio-demographic, psychosocial, and sexual behavior factors are presented in Table 1. Overall, the percentage of participants self-reporting any UAI declined marginally over time (from 46% to 39%), although this change was not statistically significant (*Odds ratio* = 0.74, *SE* = 0.15, $p = .13$). With respect to patterns of sexual behavior: 26% of participants reported UAI at both assessment points; 19% reported UAI at baseline, but not in the following 6 months; 13% reported no UAI at baseline, but had engaged in UAI by 6 month follow-up; and 41% reported no UAI at either assessment point.

Prospective logistic regression analyses

The separate models examining the association of each potential risk factor with UAI are summarized in Table 2. With regard to socio-demographic factors, Black MSM had 78% lower odds of UAI compared with White MSM, while Latino men had a three-fold greater odds compared with White men (this finding was marginally significant, at $p = .10$). Additionally, the odds of UAI for the sample overall nearly doubled with each additional sexual partner reported. With regard to psychosocial factors, any meth use was associated with nearly eight-fold greater odds of UAI and each unit increase on the 4-point perceived stress scale was associated with two-fold greater odds of UAI.

The sequential logistic regression analysis predicting UAI is presented in Table 3. Baseline UAI in Step 1 significantly predicted UAI at six months, $F(1,227) = 12.72, p < .01$. The socio-demographic variables added in Step 2 were collectively significant in predicting UAI ($F[7,1985.1] = 2.23, p = .03$). When controlling for other socio-demographic characteristics, Black MSM had a 73% reduced odds of UAI ($OR = 0.27, p = .04$), while Latino MSM had marginally elevated odds of UAI ($OR = 3.16, p = .10$). Additionally, increased number of partners was marginally associated with elevated odds of UAI ($OR = 1.84, p = .08$). Finally, the psychosocial variables added in Step 3 were collectively significant in predicting UAI, $F(4,1049.3) = 4.30, p < .01$. After controlling for psychosocial factors, the association between Black race and reduced UAI was no longer statistically significant ($OR = 0.67, p = .61$). In contrast, Latino MSM had a seven-fold increased odds of UAI after controlling for psychosocial factors. With respect to psychosocial factors, meth use was associated with an eleven-fold elevated odds of UAI ($OR = 11.43, p < .01$), each unit increase on the 4-point scale of perceived stress was associated with an eight-fold increase in the odds of UAI ($OR = 7.91, p = .02$), and each unit increase on the 4-point scale of trait anxiety was associated with an 81% reduction in the odds of UAI ($OR = 0.19, p = .02$).

Post hoc analyses

Post hoc analyses were conducted to evaluate baseline differences between Latino and White MSM that could explain the increased risk of unprotected sex among Latino men after controlling for psychosocial factors. In these analyses, each demographic and psychosocial characteristic was regressed on race/ethnicity. Logistic, ordinal, and multiple linear regressions were utilized for dichotomous, ordinal, and continuous outcomes, respectively. There were no statistically significant demographic differences between Latino and White MSM. With respect to psychosocial factors, Latino men were less likely to have endorsed past year meth use at baseline ($OR = 0.20, p = .02$).

DISCUSSION

Recent meta-analytic evidence across a variety of samples of HIV-seropositive MSM indicates a significant proportion of the MSM continue to engage in the highest risk behaviors for the sexual transmission of HIV (7). In this study, we aimed to investigate to what extent that general finding holds for our unique sample of men living with HIV/AIDS who are initiating, changing, or re-starting ARVs. Results revealed that, while the overall proportion of the sample endorsing UAI declined over time, nearly 3 in 5 men reported UAI at some point during the survey period and 1 in 4 men reported UAI at both assessment points. Thus, there exists a sizable minority (26%) of men engaging in UAI with some regularity, and a slightly larger group (32%) occasionally engaging in UAI who—from a public health perspective—are in need of intervention efforts.

We believe that it is important to understand the sexual risk behaviors of individuals living with HIV who are initiating, changing, or re-starting their ARVs. Initial concerns that

individuals may feel protected by the ARVs and, thus, be more likely to engage in UAI knowing that their transmission risk is lower—a practice termed “risk compensation” in the literature—have not been borne out by the data (24,48). We take a different perspective: we believe this is a critical period in which interventions could be delivered to reduce risk as well as promote engagement with care and ARV adherence. These interventions could involve the provision of medical information or psycho-education, brief behavioral interventions like motivational interviewing, or even more intensive multi-session interventions. Individuals who are initiating, changing, or re-starting ARVs have been judged by their providers to be sufficiently engaged with the healthcare system for them to have faith that the patient will adhere to their medication regimen and, hopefully, remain engaged with care (49,50). Accordingly, these same patients may be sufficiently motivated to participate in an intervention program. There has been a movement toward creating comprehensive intervention packages (11,15) that combine HIV-related skills building and treatment for mental health problems, like Safren’s work treating depression to improve ARV adherence (51). Our results point to one potential target of such interventions—those evidencing one or more psychosocial predictors of UAI.

Specifically, in terms of who might need a positive prevention intervention, it is possible that Latino MSM living with HIV could benefit from sexual risk reduction efforts. Although we found a small effect for Black vs. White MSM in the bivariate models, that effect was non-significant in the stepwise multivariate model. However, adjusting for baseline UAI, Latino MSM were significantly more likely than White MSM (OR = 7.48, $p = .02$) to endorse UAI six months later. We know of no other studies that report on UAI in Latino MSM initiating, changing, or re-starting ARVs; therefore, future work targeting this group may be needed. Evidence supports the notion that Latino individuals are disproportionately likely to contract HIV (52) especially Latino MSM (35), and that HIV-positive Latino MSM report engaging in more UAI than their White counterparts (53). Thus, our ethnicity related finding replicates other published work. Contextual (partner seroconcordant positive vs. serodiscordant) and relationship (main partner vs. casual partner) factors have been shown to be important predictors of UAI in Latino MSM living with HIV/AIDS (54), as well as nationality (U.S. born vs. non-U.S. born) (55) and intention to use condoms (56). If epidemiologic work continues to show similar findings, it may be useful to develop and test culturally tailored interventions specifically targeting increasing motivation and skills in condom use are needed for Latino MSM living with HIV (57,58).

Further, from the multivariate stepwise model, we see the importance of psychosocial factors emerging—UAI is significantly and strongly predicted by meth use. Meth use has been a considerable problem among urban MSM and its use is significantly associated with an increased risk of both engaging in UAI and in HIV transmission among MSM (33). There is some evidence that meth’s peak prevalence has passed (59), however, meth continues to be a treatment-resistant problem for some MSM. Meth use is also associated with other cofactors of HIV transmission, including poor ARV adherence, incident STI infections, and overall poor HIV biomarkers, and few evidence-based treatment packages for meth abuse have been identified (33). There is some published work with HIV-negative MSM combining treatment approaches for reducing both meth use and sexual risk behaviors (60), but more intervention development is needed that focuses on decreasing meth use and UAI in HIV-positive MSM (61).

This leads us to another finding from the stepwise model: controlling for baseline UAI and demographic factors, UAI is predicted by higher perceived stress. The somatic consequences of stress include acute or chronic autonomic arousal (increased heart rate, perspiration, narrowed attention on threat cues), which naturally impel individuals to take action. For some of these men, they may cope with these dysphoric internal experiences by using or

abusing substances, or engaging in UAI as a way to distract their attention from worries (62). The men may seek sexual release in order to bring about calm, euphoric feelings. Many intervention studies have focused on the psychological and physical health benefits of reducing stress among people living with HIV/AIDS (63,64); however, it is unclear to what extent stress management interventions have been disseminated systematically in HIV care settings. It could be that the necessary next steps in this line of research are to determine how best to roll out pre-existing, established interventions—such as those developed and tested in multiple chronic disease populations, including people living with HIV (65-67)—rather than to develop new ones.

Interestingly, controlling for other factors, it appears that lower trait anxiety measured at baseline increased the likelihood of a participant's reporting UAI six months later. This association is somewhat counterintuitive based on some of the published literature. Much of the work on anxiety and UAI comes from the HIV prevention literature, where a typical finding is that higher anxiety—usually conceptualized as social anxiety—predicts engagement in UAI (68). These findings, too, have been replicated in clinic and community samples of HIV-positive men (68,69). However, our finding does echo the results presented in other published reports: for example, in one study of urban HIV-positive MSM, men with the least anxiety were most likely to report receptive UAI (70). It is notable that the association between higher trait anxiety and reduced UAI emerged only after controlling for other psychosocial factors. It is possible that increased risk for UAI is being driven primarily by psychological stress and substance use, and further it is possible that the association between anxiety and UAI is non-linear. Future work should examine the mechanisms by which anxiety is related to UAI. It is possible that having more anxiety, or higher feelings of responsibility for protecting partners from HIV, might be motivating for some men to use barrier protection (71).

As with any individual study, there are limitations that restrict the generalizability of findings. First, it is notable that our sample, while representative of the HIV population in the region (72), included fewer ethnic minorities and had, on average, a higher educational attainment than most U.S. people living with HIV (3). Our findings relating to Latino MSM are derived from just 16 men. Due to sample size restrictions, we were unable to reliably assess serodiscordant UAI. When we replicated the analyses on only serodiscordant UAI, the pattern of association with socio-demographic and psychosocial factors was generally similar, but the regression estimates were highly skewed, due to sparse base rates of the outcome (i.e., separation of logistic regression estimates). Although some of the UAI included in our final analysis may have been seroconcordant, there is no way to confirm the accurate knowledge and reporting of a partner's HIV-serostatus and, thus, there is the potential that even those who reported seroconcordant UAI may not have been actually engaging in seroconcordant UAI. With respect to the statistical findings, a known characteristic of logistic regression is that odds ratios estimates in logistic regression are tied to sample size; smaller samples such as those in the present study generally lead to larger estimates of effect size (73). Therefore, the odds ratio estimates in the present study likely represent an upper estimate of effect. Finally, we relied on self-reports of UAI, a behavior that is understood to be socially undesirable among HIV-seropositive MSM. Even in confidential or anonymous studies of socially sensitive topics, there is evidence that some individuals bias their answers in the socially desirable direction. To minimize this bias, we used CASI to collect data (74-76), although it is still possible that there was still some underreporting of UAI by the sample.

In conclusion, the findings from this analysis highlight the ongoing need for the refinement and dissemination of culturally tailored, secondary HIV prevention programs for MSM living with HIV. For example, among Latino MSM, we found a need for a focus on sexual

risk reduction efforts, whereas White MSM may benefit from programs that have a substance use reduction component. Further, given the high rate of co-morbidities among our HIV-infected MSM, prevention efforts may be more effective to the extent that they specifically address decreasing sexual risk behaviors as well as improving mental health and increasing engagement with care and ARV adherence. Programs that take a holistic approach and continue to engage participants at each phase of their HIV care, starting ARVs or re-engaging in care, are needed to protect persons living with HIV—and their sexual partners—over the course of a life span.

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Table 1

Correlations among Socio-demographics, Psychosocial Factors, and Unprotected Anal Intercourse among HIV-seropositive Men who have Sex with Men in Seattle, WA, USA

	Race/Ethnicity										All	Range ^d			
	2.	3.	4.	5.	6.	7.	8.	9.	10.	Black (n=31)			Latino (n=15)	Other (n=16)	White (n=72)
										Mean (SE)					
Socio-demographics															
1. Age	-.20 [*]	.14	.36 [*]	-.02	-.24 [*]	-.15 [†]	-.19 [*]	-.23 [*]	-.23 [*]	41.48 (1.16)	36.82 (2.17)	38.80 (1.90)	38.20 (1.01)	38.88 (0.70)	19.30, 59.92
2. Number of partners ^b		.17 [*]	-.14	.05	.24 [*]	.13	.11	.52 [*]	.31 [*]	0.97 (0.16)	1.21 (0.21)	1.06 (0.25)	1.26 (0.10)	1.16 (0.08)	0, 2
3. Education level ^c			-.01	-.10	.00	-.16 [†]	-.23 [*]	.12	-.09	0.90 (0.05)	0.80 (0.11)	0.94 (0.06)	0.86 (0.04)	0.87 (0.03)	0, 1
4. Years diagnosed				-.07	-.14	-.17 [†]	-.21 [*]	-.08	-.12	9.97 (1.20)	7.42 (1.88)	9.50 (1.75)	7.84 (0.88)	8.48 (0.62)	0.01, 26.29
Psychosocial factors															
5. Alcohol use					-.15 [†]	.19 [*]	.21 [*]	.06	.02	6.90 (1.66)	5.47 (2.16)	5.31 (1.70)	3.71 (0.54)	4.84 (0.58)	0, 38
6. Meth use ^c						.13	.13	.09	.44 [*]	0.10 (0.06)	0.20 (0.11)	0.56 (0.13)	0.56 (0.06)	0.41 (0.04)	0, 1
7. Perceived stress							.83 [*]	.16 [†]	.22 [*]	1.69 (0.12)	1.84 (0.15)	1.74 (0.16)	1.84 (0.07)	1.79 (0.05)	0.29, 3.43
8. Trait anxiety								.14	.09	2.04 (0.13)	2.11 (0.17)	1.88 (0.13)	2.24 (0.08)	2.14 (0.06)	1.00, 3.90
Unprotected anal intercourse															
9. Baseline ^c									.34 [*]	0.45 (0.09)	0.60 (0.13)	0.31 (0.12)	0.46 (0.06)	0.46 (0.04)	0, 1
10. 6 months ^c										0.15 (0.07)	0.69 (0.13)	0.53 (0.14)	0.41 (0.06)	0.39 (0.04)	0, 1

Note.

* $p < .05$.

[†] $p < .10$.

^a Range taken from the non-imputed data.

^b 0 = no partners, 1 = 1 partner, 2 = 2+ partners.

^c Mean interpreted as the proportion of participants coded as 1.

Table 2

Separate Logistic Regression Analyses Predicting Unprotected Anal Intercourse among HIV-seropositive Men who have Sex with Men in Seattle, WA, USA

Variable	<i>Estimates^a</i>		
	<i>OR^b</i>	<i>95% CI^c</i>	<i>p</i>
<i>Socio-demographics</i>			
Age	0.95	0.90 – 1.01	.10
Race/Ethnicity ^d			
• Black vs. White	0.22	0.06 – 0.77	.02
• Latino vs. White	3.13	0.80 – 12.28	.10
• Other vs. White	2.25	0.64 – 7.91	.21
Education level	0.40	0.11 – 1.46	.16
Number of partners	1.68	0.95 – 2.95	.07
Years diagnosed with HIV	0.97	0.92 – 1.03	.27
<i>Psychosocial factors</i>			
Alcohol use	1.00	0.94 – 1.06	.99
Meth use	7.83	2.89 – 21.22	< .01
Perceived stress	2.01	1.00 – 4.05	.05
Trait anxiety	1.16	0.66 – 2.05	.61

Note.

^a Each of the nine models controlled for baseline unprotected anal intercourse.

^b OR = Odds Ratio.

^c CI = Confidence Interval.

^d Omnibus Wald Test for Race/Ethnicity: $F(3,1498.1) = 3.97, p = .01$.

Summary of Sequential Logistic Regression Analysis Predicting Unprotected Anal Intercourse among HIV-seropositive Men who have Sex with Men in Seattle, WA, USA

Table 3

Variable	Step 1 ^a			Step 2 ^b			Step 3 ^c		
	OR ^d	95% CI ^e	p	OR ^d	95% CI ^e	p	OR ^d	95% CI ^e	p
<i>Step 1: Covariates</i>									
Baseline UAI ^f	4.19	1.90 – 9.24	< .01	3.51	1.27 – 9.66	.02	5.58	1.48 – 21.05	.01
<i>Step 2: Socio-demographics</i>									
Age				0.98	0.91 – 1.05	.51	1.00	0.92 – 1.08	.91
Race/Ethnicity									
• Black vs. White				0.27	0.07 – 0.96	.04	0.67	0.14 – 3.23	.61
• Latino vs. White				3.16	0.81 – 12.40	.10	7.48	1.47 – 38.02	.02
• Other vs. White				2.90	0.70 – 12.06	.14	3.10	0.37 – 26.10	.29
Education level				0.35	0.08 – 1.50	.16	0.24	0.04 – 1.55	.13
Number of partners				1.84	0.94 – 3.60	.08	1.41	0.62 – 3.21	.41
Years diagnosed with HIV				0.99	0.92 – 1.06	.69	0.98	0.90 – 1.06	.57
<i>Step 3: Psychosocial factors</i>									
Alcohol use							1.02	0.94 – 1.11	.68
Meth use							11.43	2.86 – 45.73	< .01
Perceived stress							7.91	1.45 – 43.05	.02
Trait anxiety							0.19	0.05 – 0.79	.02

Note.

^a For Step 1, $F(1,227) = 12.72, p < .01$.

^b For Step 2, $F(7,1985.1) = 2.23, p = .03$.

^c For Step 3, $F(4,1049.3) = 4.30, p < .01$.

^d OR = Odds Ratio;

^e CI = Confidence Interval.

^f UAI = unprotected anal intercourse.