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Title

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Permalink

<https://escholarship.org/uc/item/4cs573cq>

Journal

JAIDS Journal of Acquired Immune Deficiency Syndromes, 78(5)

ISSN

1525-4135

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Publication Date

2018-08-15

DOI

10.1097/qai.0000000000001716

Peer reviewed

Risk and Vulnerability of Black Men in HPTN 061

Title: Differential Patterns of Risk and Vulnerability Suggest the Need for Novel Prevention Strategies for Black Bisexual Men in the HPTN 061 Study

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Conflicts of Interest and Sources of Funding:

Declaration of Conflicts of interest: None.

Funding: This study was supported by NIAID, NIDA, and NIMH under cooperative agreement #UM1 AI068619 as part of the HPTN Scholars Program. Dr. Dyer additionally received funding from as well as The UCLA HIV/AIDS Translational Training Program (R25 MH-080644), Johns Hopkins Drug Dependence Epidemiology Training Program (2-T32 DA-007292-17), Project DISRUPT (R01 DA-028766) and UCLA CHIPTS (P30 MH 058107). The HPTN 061 Manuscript Review Committee made the final decision to submit the manuscript for publication.

Acknowledgements: Steve Shoptaw, PhD with the UCLA Vine Street Clinical Research Site and HPTN Scholar mentor; HPTN 061 Study Participants; HPTN 061 Protocol Co-Chairs: Beryl Koblin, PhD, Kenneth Mayer, MD, Darrell Wheeler, PhD, MPH; HPTN 061 Protocol Team Members; HPTN Black Caucus; HPTN Network Laboratory, Johns Hopkins University School of Medicine; Vaccine and Infectious Disease Division, Fred Hutchinson Cancer Research Center; HPTN CORE Operating Center, FHI 360; The Black Gay Research Group; Clinical Research Sites, Staff and CABs at Emory University, Fenway Institute, GWU School of Public Health and Health Services, Harlem Prevention Center, New York Blood Center, San Francisco Department of Public Health, and UCLA.

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Abstract

Background: Black men who have sex with men (BMSM); some who also have sex with women (BMSMW), account for over 70% of new HIV infections in the US representing an elevated HIV risk in this group, also informing risks for HIV transmission to other BMSM and female sexual partners.

Settings: We examined trajectories of self-reported substance use, HIV-related sexual risk behaviors and psychosocial vulnerabilities among BMSMW versus BMSM over a one-year study period.

Methods: We analyzed baseline, 6- and 12-month follow-up data from the HIV Prevention Trials Network (HPTN) “BROTHERS” Study (HPTN 061; n=1126). Categorizing participants by sexual partner type across three time points: (1) BMSMO: having male and no female partners across assessments and (2) BMSMW: having sex male and one or more female partners at least at one time point. Using generalized estimating equations (GEE) we estimated associations between being BMSMW (versus BMSMO) and changes in psychosocial vulnerability, substance use, and HIV-related sexual risk behaviors.

Results: GEE models controlling for sociodemographics, time-varying effects, and intervention status showed that BMSMW versus BMSMO had 50% increased odds of crack use, 71% increased odds of alcohol use during condomless anal intercourse (CAI), 51% greater odds of using drugs at last CAI, and twice the odds of receiving goods at last CAI.

Conclusions: Findings show stable and comparatively elevated illicit drugs, alcohol and exchange sex during last CAI among BMSMW. Future intervention research should focus on

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ways to address changes in substance-related HIV transmission behaviors over time in this population of men.

Keywords: substance use, Black MSM, Black MSMW, HIV sexual risk, repeated measures, cohort studies

1.1 Introduction:

HIV persists as a critical public health concern in the United States (U.S.) (Centers for Disease Control and Prevention, December 2016). HIV prevalence in certain sub-populations, such as Black men who have sex with men (BMSM), are comparable to those observed in endemic regions such as sub-Saharan Africa (El-Sadr et al., 2010). Preliminary incidence data from the HIV Prevention Trials Network 061 study (HPTN 061), a large multisite study to determine the feasibility and acceptability for an integrative HIV prevention intervention among BMSM in six urban areas in the U.S., highlighted the severe disproportionate risk of HIV in this population (Mayer, 2012); 3% of the men became newly infected over 12 months, with the majority of these infections occurring in young BMSM (i.e., less than 30 years of age) (Koblin et al., 2013).

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Sex with both men and women has been well substantiated as common in behavioral studies of Black same gender loving men (Dyer et al., 2015; Dyer et al., 2013; Harawa et al., 2014; Latkin et al., 2011). At baseline, among participants in the HPTN 061 study 46% were men reported sex with both men and women (BMSMW) in the six months prior to enrollment (Koblin et al., 2013). Though HIV incidence over the year was highest among Black men who only had sex with men (BMSMO) (46.9 per 1000 PY), incidence among BMSMW also was high (17.5 per 1000 PY) (Koblin et al., 2013). These data highlight the potential for some BMSMW to transmit HIV to other BMSM as well as to their female sexual partners (Dyer et al., 2015; Jeffries, 2014; Latkin et al., 2011). The risk context among BMSMW is therefore, worthy of exploration.

BMSMW have elevated risk of engaging in HIV-related sexual risk behaviors with both male partners compared to BMSMO and female partners compared to Black men who have sex with women only (BMSWO) (Lauby et al., 2008; Singh et al., 2014; Spikes et al., 2009). A study exploring types of female partners among Black MSMW and associated sexual risk behaviors found that MSMW reported more than three times as many total and condomless sex acts with each primary female partner as they did with each non-primary female partner, heightening potential HIV risk to primary female partners (Harawa et al., 2014).

Psychosocial vulnerabilities, including depression, internalized homophobia, poor social support, and substance use, are key correlates of HIV-related sex risk behaviors, such as engaging in CAI (Bruce et al., 2012; Gorbach et al., 2009; Mayer et al., 2006; Plankey et al., 2007; Vosburgh et al., 2012). Prior studies suggest a high burden of substance use within the

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BMSM community at risk for HIV transmission (Boone et al., 2012; Buttram et al., 2012; Mimiaga et al., 2009; Wilton, 2008), further highlighting that HIV prevention interventions should address substance-related factors. BMSMW may be substantially more likely to engage in high-risk sex with both male and female partners, particularly concomitant with alcohol use (Dyer et al., 2013), with BMSMW being more likely to report substance use with their male sexual partners, particularly crack/cocaine and alcohol use compared to BMSMO (Dyer et al., 2015). A growing number of studies have focused on correlates of substance use, particularly alcohol and HIV risk behavior among BMSM, while others have indicated that drug use has often served as a central facilitating factor for Black male same-sex activity (Harawa et al., 2008; Mansergh et al., 2015); with alcohol, crack/cocaine, and crystal methamphetamine being common drugs used for this purpose (Mimiaga et al., 2010; Shoptaw et al., 2009; Wilton, 2008). These findings underscore the heterogeneous nature and the fluidity of sexual orientation among BMSM (Baldwin et al., 2015; Garcia et al., 2016; Rutledge et al., 2016; Truong et al., 2016), some of whom have female partners, as it relates to substance use and sexual risk when engaging same-sex activity, which may also change over time as can the sex of their partners (Harawa et al., 2008). Examining and developing an understanding of changes in substance use patterns among BMSMO and BMSMW is critical to developing effective culturally-relevant prevention intervention strategies that are tailored to the specific needs of each group and take into account the stability of HIV-related risk behaviors (Tobin et al., 2016).

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Cross-sectional study evidence has indicated BMSMW experience differential structural and psychosocial vulnerabilities, with findings from several studies showing that these men were more likely to report elevated depression symptoms, poverty, unemployment, unstable housing, and incarceration compared to BSMO—all of which describe contexts that are conducive to increased HIV-risk behaviors and potentially HIV transmission (Allen Jr et al., 2014; Brewer et al., 2014a, b; Dyer et al., 2015; Dyer et al., 2013; Nelson et al., 2016; Wheeler et al., 2008). Wheeler et al. found that BMSMW were more likely to report an annual income of less than \$5,000, a limited education, two or more arrests during their lifetime, engaging exchange sex for money, food, or shelter, reporting illicit drug use during the last three months, and heavy alcohol use during the last three months, as compared to BSM (Wheeler et al., 2008). Findings from a recent formative study on HIV testing and health perceptions demonstrated that BMSMW reported an annual household income of less than \$10,000, inadequate health insurance coverage, and concerns about privacy, stigma, and HIV risk (Cooke et al., 2016). What is not known is whether the disproportionate HIV-related sexual risk behavior and underlying psychosocial vulnerability and substance use observed cross-sectionally in BMSMW study populations remains stable over time.

In this study, we utilized a prospective cohort study design to assess substance use, HIV-related sexual risk behaviors and psychosocial vulnerability among BSMO and BMSMW repeatedly over a year with two follow-up visits (every 6 months). The aim of the study was to describe differences in psychosocial and HIV-related risk behaviors (both substance use and sexual) of BMSMW and BSMO observed over a one-year period in participants from HPTN

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061. Based on prior research (Dyer et al., 2013; Shoptaw et al., 2009) we hypothesized that BMSMW would be more likely to continue engaging in high-risk behaviors (both substance use and sexual related) compared to BMSMO and that BMSMW would remain more psychosocially vulnerable, even after accounting for time-varying effects, compared to BMSMO.

2.1 Material and Methods:

2.1.1 Study design and study participants

The current study was part of the HIV Prevention Trials Network (HPTN) 061 Study, also known as the BROTHERS (Broadening the Reach of Testing, Health Education, Resources and Services) Project. HPTN 061 used a cohort study design including one baseline and two follow-up visits at 6 and 12 months that was conducted between July 2009 and December 2011. The overall objective of HPTN 061 was to determine the feasibility and acceptability of a multi-component intervention to reduce HIV infection among BMSM in the U.S. in six cities including Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington, DC. The institutional review boards at the participating institutions approved the study. A detailed description of the recruitment methods for the study have been described in detail elsewhere (Dyer et al., 2013).

A total of 1,553 participants, were enrolled in the study at baseline. Of those enrolled, 1,371 cis-men (identified as male at birth and currently identify as men) participants who had at least one male partner at any visit were included in the analysis. Since the sample of cis-men reported varying or no sex partner genders across multiple time points, only men for whom sex partner type data were present at a minimum of two time points and who did not indicate that

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their sex partners were transgender or transsexual were included (n=1,126). Therefore, the analytic cohort for this study included cis-men participants who reported at least one partner who was a cis-man at *any* of the three visits. At each follow-up visit, we asked the same questions regarding the men's substance use, psychosocial vulnerability and HIV-related sexual risk in the six months prior to the assessment.

2.1.2 Measures:

2.1.2.1 Sociodemographic variables included age, education, income, employment status, housing stability, incarceration history, study site location, and intervention assignment.

2.1.2.2. Exposure Variable

Defining BMSMW and BSMO Status. At each study visit (baseline, 6-, and 12-month), a participant was asked to report the number of cis-man and cis-woman partners he had in the prior six months. Participants were categorized into two groups: (1) having male partner(s) exclusively and (2) having both male and female partners at any time during the study (Koblin et al., 2013).

Outcome Variables

2.1.2.3 Substance Use Variables

A screening question asked participants whether they had used marijuana, crack cocaine, powder cocaine, or methamphetamine in the past six months (Dyer et al., 2013). Individual items then asked participants to report the frequency of use (e.g. daily use) of specific drugs reported. Those who denied drug use in the past six months were coded "0=None" for each type of drug. Participants who answered "Yes" to the screener were then asked, "How many days did you use 'x' 'drug' in the past 6 months?" Response categories were, "1=Daily," "2=Several times a

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week,” “3=Weekly,” “4= Several times a month,” “5=Monthly,” “6=A few times,” and “7=Once.” These categories then were collapsed to create a 3-level variable reflecting frequency of substance use. The categories were “0=None,” 1=Rarely or Occasionally (Several times a month, Monthly, A few times, or Once) and 2 = Frequently (Daily, Several times a week, or Weekly).

At each study visit (baseline, 6-, and 12-month), participants were also asked “In the last 6 months, how many drinks containing alcohol did you have on a typical day when you were drinking?” Response categories were, “1=1 or 2,” “2=3 or 4,” “3=4,” “4= 5 or more.” These categories then were collapsed to create a dichotomous variable reflecting participants who drank 5 or more drinks versus those who drank less than 5 drinks (Naimi et al., 2003).

2.1.2.4 Psychosocial Vulnerability Variables

Depression Symptoms: The Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) was used to measure symptoms of depression. The CES-D is a 20-item, 4-point Likert-type scale ranging from (0=Rarely or None of the Time, 1=Some or Little of the Time, 2=Moderately or Much of the Time, and 3=Most or Almost All the Time). The sum of all the scores was computed for participants who answered all 20 questions on the CES-D. A score of 16 or higher was considered to denote moderate depression symptoms. The Cronbach alpha coefficient indicated high internal consistency ($\alpha = 0.94$).

Internalized homophobia: A 7-item, 5-point Likert-type scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*), adapted from Herek and colleagues (1998) was used to measure internalized homophobia (Herek et al., 1998). Sample items included: “I have tried to stop being

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attracted to men”, “If someone offered me the chance to be completely heterosexual, I would accept the chance”, “I wish I weren’t attracted to men” and “I feel bad about being attracted to men because my community looks down on men who are attracted to other men.” Possible scores ranged from 7-35. The mean was calculated for participants who answered at least 5 of the 6 items in the scale. The alpha coefficient showed high internal consistency for both subpopulations of men ($\alpha = 0.90$ for BMSMW and $\alpha = 0.88$ for BMSM).

2.1.2.5 HIV-related Sexual Risk Behavior Variables

Any Drug Use within 2 Hours of Last CAI. At each study visit, respondents were asked whether they had used marijuana, crack cocaine, powder cocaine (i.e. coke), or methamphetamine in the past six months. The “any drug use” score proximal to condomless anal intercourse (CAI) was derived if any of the above-mentioned substances were reported used within two hours of last CAI (Dyer et al., 2013).

Alcohol Use within 2 Hours of Last CAI. Similarly, at each study visit (month 0, 6, and 12), respondents were also asked “In the last 6 months, how many drinks containing alcohol did you have on a typical day when you were drinking?” Response categories were, “1=1 or 2,” “2=3 or 4,” “3=4,” “4= 5 or more.” The “any alcohol use” proximal to CAI was derived from participants’ responses to whether alcohol was ever used within two hours of CAI (Dyer et al., 2013).

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Involvement in Sex Exchange. Two items asked whether participants either received *or* gave money, drugs, other goods, or a place to stay the last time they had CAI. Each question was coded as a dichotomous (Yes/No) outcome, indicating whether participants engaged in exchange sex.

2.2 Statistical Analyses:

Baseline, 6- and 12-month demographics, substance use, sex risks, and psychosocial characteristics were summarized for BMSMW and BMSMO.

For categorical variables, chi-square tests were used to compare differences in characteristics between the two groups of men, whereas for continuous variables, Wilcoxon rank sum tests were used. Next, as both exposure and outcome variables were repeated measures, we used logistic regression using generalized estimating equations (GEE) to estimate associations between being BMSMW (versus BMSMO) and substance use, psychosocial vulnerability (internalized homophobia and depression), and HIV-related sexual risk behaviors at baseline, 6-, and 12- months. Each respondent constituted a cluster to be accounted for and we specified an exchangeable working correlation matrix. We then fit GEE models for binomial outcomes including drug use within two hours or during the last CAI with men in the last 6 months, alcohol use within two hours of last CAI with men in the last 6 months, and exchange sex, depression and internalized homophobia. Each GEE model included the sexual behavioral category (i.e. BMSMW and BMSMO), one-year change and the interaction of the two. If the interaction term was not statistically significant, we fit a second model without the interaction, and reported the odds ratio (OR) estimates from the second model. For all adjusted models, we

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controlled for age, education, incarceration, housing status, income and study site.(Dyer et al., 2013) We additionally adjusted each model for the key confounder, intervention group assignment. All analyses were conducted using SAS 9.2 (SAS Institute and SAS Publishing, 2011).

2.3 Results:

Fifty-four percent of men in the study were BSMO, another 46% were BSMW. Compared to BSMO, BSMW were significantly older, less educated, had lower incomes and were more likely to be unemployed, less stably housed, and more likely to have been incarcerated prior to enrollment. Baseline characteristics have been summarized elsewhere (Dyer et al., 2013).

Table 1 illustrates baseline, 6- and 12-month comparisons of substance use, psychosocial characteristics and HIV-related sexual risk of BSMW and BSMO. At baseline, compared with BSMO, BSMW were significantly more likely to report elevated levels of marijuana use (41.3% vs 29.5%, $p<.0001$). These differences were no longer significant at 6- and 12-month follow-up, with BSMW reporting similar levels of marijuana use at 6- (25.5% vs 21.4%, $p=0.14$) and 12-month follow up (24.9% vs 21.3%, $p=0.19$). At baseline compared with BSMO, BSMW were significantly more likely to report elevated levels of cocaine use (29.3% vs. 7.9%, $p<.0001$) within two hours of CAI. These differences remained significantly elevated for BSMW at 6- (16.8% vs. 5.5%, $p<.0001$) and 12-month follow-up (12.0% vs. 5.1%, $p<.0001$). BSMW also reported more crack use at baseline compared to BSMO (14.4% vs. 5.6%, $p<.0001$) and these differences remained at 6- (9.3% vs. 4.6%, $p<.01$) and 12-

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month follow up (6.5% vs. 2.0%, $p < .001$). At baseline, BMSMW were also more likely to report alcohol use within 2 hours of CAI (60.4% vs. 52.7%, $p = .012$) compared to BMSMO however, these differences were no longer significant at 6- and 12- month follow up. BMSMW were also significantly more likely to report that they reported they received drugs, money or goods for sex (34.8% vs. 7.7%, $p < .0001$), as well as being more likely to give drugs, money or goods for sex (13.3% vs. 6.9%, $p = .0005$) and these differences remained at 6- and 12-month follow-up.

Results of the unadjusted and adjusted models estimating group differences over time in psychosocial, substance use and HIV-related sexual risk behaviors are shown in Table 2. Adjusting for sociodemographic covariates, time, study site and intervention status compared to BMSMO, BMSMW reported 50% increased odds of crack use, 71% increased odds of alcohol use at last CAI, a 51% increased odds of any drug use at last CAI and twice the odds of receiving drugs, money or other goods at last CAI. Results also show that over the one year time period the rates for each outcome decreased overall for the entire sample, however remained elevated for BMSMW, as detailed above. BMSMW also continued to report elevated levels of depression (25%) and elevated levels of internalized homophobia (65%) compared to BMSMO.

2.4 Discussion:

Confirming our hypotheses, multivariate GEE models showed that overall differences in experience with substance use, internalized homophobia, sex while under the influence of drugs and alcohol, as well as involvement in sex trade, remained significantly elevated in BMSMW compared to BMSMO, excepting for use of marijuana. BMSMW increased rates of CAI while under the influence of alcohol and other drugs, suggests that there may remain a high

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psychosocial burden associated with engaging in sex with men that contributes to the use of substances. BMSMW also remained at higher odds of reporting receiving goods for sex, compared to BSMO. Given the lower SES and higher substance use rates in BMSMW versus BSMO survival sex and sex-for-drug-related exchanges are important considerations in this group.

Moreover, the drugs used concomitant with sexual risk taking, were frequently crack and cocaine. While all drug and alcohol use impacts cognitive functioning (Gautam et al., 2015), these particular stimulants may also function to allow the men to overcome feelings of depression and thoughts of internalized homophobia sufficiently for the men to engage in desired sexual behaviors with other men. This may explain findings showing that while BMSMW may report greater use of substances, their rates of sexual risk behaviors are lower than for BSMO because they engage in sex with men less often than do BSMO (Dyer et al., 2015).

Findings document that classifying behavioral risk groups into discreet categories using data from a single time point is not sufficient to capture risks faced by a group of BMSMW -- specifically, men who reported having only male partners at baseline and then female partners at future time points. An understanding of how varying partner gender shifts over a one-year time-frame may inform recruitment of BMSMW into studies, as well as understanding of their needs over time and how these influence tailoring interventions. At minimum, these findings raise the likelihood of the issue of misclassification bias when categorizing men into behavioral risk groups using cross-sectional data.

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It also must be noted that prevalent and incident incarceration was high in the sample (Brewer et al., 2014a, b), indicating a syndemic condition, i.e., high incarceration rates, along with psychosocial vulnerabilities that may influence choices around partner types and behaviors that may put self at risk, as well as their partners. Incarceration also may have implications when considering survival sex within the BMSMW population.

There are several limitations to the current study. One is that the study was limited to six urban US cities, which decreases our ability to generalize findings to the Black community in general and Black MSM in other geographic regions, more specifically. Because of eligibility criteria for the HPTN 061 study, the cohort was at higher risk than a more generalized sample that would include Black MSM who did not report unprotected sex at enrollment. Although ACASI may minimize social desirability bias, ACASI data are nonetheless based on self-report and social desirability bias may persist and potentially differ between BMSMO and BMSMW. Additionally, the possibility of spurious associations due to misclassification as a result of other forms of bias (e.g., recall) cannot be ruled out.

Despite these limitations, the findings have strong implications for research among BMSMW and BMSMO. Of specific interest is understanding the risk contexts of BMSMW and BMSMO that may change over time. Utilizing a repeated measures study design allows for the men to be classified as BMSMW and BMSMO based on self-reported sexual partners over time, reducing the potential for misclassification bias that may arise from assessing self-reported sexual partners within a short time frame (e.g. 6 months). The longitudinal nature of the current analysis also allowed for the documentation of sexual behavior and partnership types over a

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longer period of time, thus reducing the potential for misclassification. Additionally, while the study was limited to six urban US cities, there is strength in that this sample represents different geographic areas and hence different epidemic profiles of BMSMW and BMSMO.

2.5 Conclusions:

The findings from this study highlight the fact that BMSMW engaged in more substance use, were also more psychosocially vulnerable, and had elevated risk for engaging in HIV-related sexual risk behaviors when engaging in sex with men. However, it should be noted that findings from the repeated measures indicated that patterns of risk were similar to what was found at baseline for BMSMW compared to BMSMO. This is important because it reflects some persistent risks and vulnerability within this group that may otherwise be characterized as “going through a phase” (i.e. misclassified) or that BMSMW were “out” enough to be participants in a study, which was tailored for BMSM.

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Table 1. Comparisons of reported substance use, HIV-related sex risks, and psychosocial vulnerability characteristics of Black MSMO and MSMW at Baseline, 6 month- and 12-month follow-up visits (N=1126)

Characteristics	BASELINE		6 MONTHS		12 MONTHS	
	MSMO (N=537)	MSMW (N=542)	MSMO (N=508)	MSMW (N=472)	MSMO (N=508)	MSMW (N=472)
How often did you use Marijuana						
No	257/ 530 (48.5%)	197/ 524 (37.6%)	243/ 499 (48.7%)	185/ 482 (38.4%)	250/ 501 (49.9%)	199/ 456 (43.6%)
Rarely or occasionally	133/ 530 (25.1%)	132/ 524 (25.2%)	132/ 499 (26.5%)	142/ 482 (29.5%)	112/ 501 (22.4%)	117/ 456 (25.7%)
Frequently	140/ 530 (26.4%)	195/ 524 (37.2%)*	124/ 499 (24.8%)	155/ 482 (32.2%)*	139/ 501 (27.7%)	140/ 456 (30.7%)
Used Marijuana within 2 hours of CAI						
Yes	156/ 529 (29.5%)	217/ 525 (41.3%)*	107/ 499 (21.4%)	121/ 475 (25.5%)	107/ 502 (21.3%)	113/ 454 (24.9%)
No	373/ 529 (70.5%)	308/ 525 (58.7%)	392/ 499 (78.6%)	354/ 475 (74.5%)	395/ 502 (78.7%)	341/ 454 (75.1%)
How often did you use powder cocaine						
No	452/ 521 (86.8%)	311/ 506 (61.5%)	434/ 487 (89.1%)	328/ 474 (69.2%)	441/ 495 (89.1%)	317/ 441 (71.9%)
Rarely or occasionally	46/ 521 (8.8%)	112/ 506 (22.1%)	34/ 487 (7.0%)	85/ 474 (17.9%)	37/ 495 (7.5%)	81/ 441 (18.4%)
Frequently	23/ 521 (4.4%)	83/ 506 (16.4%)*	19/ 487 (3.9%)	61/ 474 (12.9%)*	17/ 495 (3.4%)	43/ 441 (9.8%)*
Used powder cocaine within 2 hours of CAI						
Yes	41/ 522 (7.9%)	148/ 505 (29.3%)*	27/ 488 (5.5%)	80/ 476 (16.8%)*	25/ 494 (5.1%)	53/ 440 (12.0%)*
No	481/ 522 (92.1%)	357/ 505 (70.7%)	461/ 488 (94.5%)	396/ 476 (83.2%)	469/ 494 (94.9%)	387/ 440 (88.0%)
How often did you use crack cocaine						
No	448/ 517 (86.7%)	388/ 502 (77.3%)	430/ 487 (88.3%)	359/ 454 (79.1%)	437/ 494 (88.5%)	359/ 430 (83.5%)
Rarely or occasionally	52/ 517 (10.1%)	86/ 502 (17.1%)	50/ 487 (10.3%)	73/ 454 (16.1%)	52/ 494 (10.5%)	57/ 430 (13.3%)
Frequently	17/ 517 (3.3%)	28/ 502 (5.6%)*	7/ 487 (1.4%)	22/ 454 (4.8%)*	5/ 494 (1.0%)	14/ 430 (3.3%)*
Used crack coke within 2 hours of CAI						
Yes	29/ 518 (5.6%)	72/ 501 (14.4%)*	22/ 488 (4.5%)	45/ 453 (9.9%)*	10/ 494 (2.0%)	28/ 429 (6.5%)*
No	489/ 518 (94.4%)	429/ 501 (85.6%)	466/ 488 (95.5%)	408/ 453 (90.1%)	484/ 494 (98.0%)	401/ 429 (93.5%)
How often did you use Methamphetamine						
No	470/ 518 (90.7%)	441/ 488 (90.4%)	444/ 483 (91.9%)	411/ 450 (91.3%)	459/ 496 (92.5%)	396/ 430 (92.1%)
Rarely or occasionally	38/ 518 (7.3%)	37/ 488 (7.6%)	33/ 483 (6.8%)	29/ 450 (6.4%)	28/ 496 (5.6%)	22/ 430 (5.1%)
Frequently	10/ 518 (1.9%)	10/ 488 (2.0%)	6/ 483 (1.2%)	10/ 450 (2.2%)	9/ 496 (1.8%)	12/ 430 (2.8%)
Used Methamphetamine within 2 hours of CAI						

Characteristics	BASELINE		6 MONTHS		12 MONTHS	
	MSMO (N=537)	MSMW (N=542)	MSMO (N=508)	MSMW (N=472)	MSMO (N=508)	MSMW (N=472)
Yes	30/ 518 (5.8%)	29/ 488 (5.9%)	24/ 483 (5.0%)	19/ 452 (4.2%)	19/ 496 (3.8%)	17/ 430 (4.0%)
No	488/ 518 (94.2%)	459/ 488 (94.1%)	459/ 483 (95.0%)	433/ 452 (95.8%)	477/ 496 (96.2%)	413/ 430 (96.0%)
Used any substance (marijuana, cocaine, coke and meth) within 2 hours of anal sex						
Yes	204/ 527 (38.7%)	328/ 524 (62.6%)****	174/ 492 (35.4%)	225/ 471 (47.8%)****	181/ 502 (36.1%)	198/ 447 (44.3%)**
No	323/ 527 (61.3%)	196/ 524 (37.4%)	318/ 492 (64.6%)	246/ 471 (52.2%)	321/ 502 (63.9%)	249/ 447 (55.7%)
Used alcohol within 2 hours of CAI						
Yes	280/ 531 (52.7%)	323/ 535 (60.4%)**	231/ 505 (45.7%)	225/ 495 (45.5%)	207/ 504 (41.1%)	187/ 468 (40.0%)
No	251/ 531 (47.3%)	212/ 535 (39.6%)	274/ 505 (54.3%)	270/ 495 (54.5%)	297/ 504 (58.9%)	281/ 468 (60.0%)
Past incarceration						
Yes	229/ 531 (43.1%)	392/ 531 (73.8%)****	38/ 503 (7.6%)	91/ 495 (18.4%)****	37/ 506 (7.3%)	95/ 466 (20.4%)****
No	302/ 531 (56.9%)	139/ 531 (26.2%)	465/ 503 (92.4%)	404/ 495 (81.6%)	469/ 506 (92.7%)	371/ 466 (79.6%)
internalized homophobia (dichotomized)						
Yes	206/ 522 (39.5%)	258/ 513 (50.3%)**	174/ 490 (35.5%)	225/ 480 (46.9%)**	161/ 498 (32.3%)	195/ 446 (43.7%)**
No	316/ 522 (60.5%)	255/ 513 (49.7%)	316/ 490 (64.5%)	255/ 480 (53.1%)	337/ 498 (67.7%)	251/ 446 (56.3%)
mean internalized homophobia (scale) ²	2.0 (1.2, 3.0)	1.7 (1.0, 2.5)****	2.0 (1.0, 3.0)	1.7 (1.0, 2.3)****	2.0 (1.0, 3.0)	1.3 (1.0, 2.3)****
Score of 'as a black man, I try to act more masculine to hide my sexuality' ²	2.0 (1.0, 4.0)	2.0 (1.0, 3.0)****	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)****	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)****
CES-D (dichotomized)						
Non-depression (0-15)	328/ 511 (64.2%)	264/ 488 (54.1%)	306/ 480 (63.8%)	244/ 450 (54.2%)	312/ 484 (64.5%)	234/ 425 (55.1%)
Depression (>=16)	183/ 511 (35.8%)	224/ 488 (45.9%)**	174/ 480 (36.3%)	206/ 450 (45.8%)**	172/ 484 (35.5%)	191/ 425 (44.9%)*
Number of male partners ²	3.0 (2.0, 5.0)	3.0 (2.0, 6.0)	2.0 (1.0, 4.0)	2.0 (1.0, 4.0)****	1.0 (1.0, 3.0)	2.0 (1.0, 3.0)****
Buzzed/drunken last time had anal sex						
Yes	182/ 534 (34.1%)	322/ 523 (61.6%)****	141/ 481 (29.3%)	194/ 379 (51.2%)****	124/ 465 (26.7%)	157/ 320 (49.1%)****
No	352/ 534 (65.9%)	201/ 523 (38.4%)	340/ 481 (70.7%)	185/ 379 (48.8%)	341/ 465 (73.3%)	163/ 320 (50.9%)
Used drug last time had anal sex						
Yes	133/ 532 (25.0%)	266/ 522 (51.0%)****	106/ 482 (22.0%)	170/ 376 (45.2%)****	111/ 466 (23.8%)	146/ 320 (45.6%)****

Characteristics	BASELINE		6 MONTHS		12 MONTHS	
	MSMO (N=537)	MSMW (N=542)	MSMO (N=508)	MSMW (N=472)	MSMO (N=508)	MSMW (N=472)
No	399/ 532 (75.0%)	256/ 522 (49.0%)	376/ 482 (78.0%)	206/ 376 (54.8%)	355/ 466 (76.2%)	174/ 320 (54.4%)
Receiving money/goods from last male partner						
Yes	41/ 532 (7.7%)	183/ 526 (34.8%)****	33/ 482 (6.8%)	88/ 381 (23.1%)****	23/ 466 (4.9%)	64/ 318 (20.1%)****
No	491/ 532 (92.3%)	343/ 526 (65.2%)	449/ 482 (93.2%)	293/ 381 (76.9%)	443/ 466 (95.1%)	254/ 318 (79.9%)
Giving money/goods to last male partner						
Yes	37/ 534 (6.9%)	70/ 525 (13.3%)***	25/ 480 (5.2%)	54/ 377 (14.3%)****	20/ 464 (4.3%)	39/ 318 (12.3%)****
No	497/ 534 (93.1%)	455/ 525 (86.7%)	455/ 480 (94.8%)	323/ 377 (85.7%)	444/ 464 (95.7%)	279/ 318 (87.7%)

1. Chi-square test p-values are reported, unless noted otherwise.

**** p<=.0001 (MSMW vs. MSMO)

***p<=.001 (MSMW vs. MSMO)

** p<=.01 (MSMW vs. MSMO)

*p<=.05 (MSMW vs. MSMO)

2. Median (Q1, Q3) and Wilcoxon Rank Sum test p-value are reported.

3. Sample size differs due to characterization of MSMW vs. MSMO status across time points.

Table 2. Unadjusted and Adjusted Models of Longitudinal Trajectories in Substance Use, HIV-Related Sexual Risk Behaviors and Psychosocial Vulnerabilities among BMSMO and BMSMW

	UOR (95% CI)	AOR (95% CI)
Crack Use		
BMSMO	Ref.	Ref.
BMSMW	1.87 (1.42 - 2.45)	1.50 (1.11 - 2.03)
Time (1 Year Increase)	0.77 (0.64 - 0.92)	0.74 (0.61 - 0.89)
Methamphetamine		
BMSMO	Ref.	Ref.
BMSMW	1.08 (0.75 - 1.56)	0.86 (0.56 - 1.31)
Time (1 Year Increase)	0.83 (0.66 - 1.04)	0.79 (0.61 - 1.01)
Any Drug Use within 2 Hours of Last CAI		
BMSMO	Ref.	Ref.
BMSMW	2.01 (1.35 - 3.01)	1.51 (0.99 - 2.28)
Time (1 Year Increase)	0.57 (0.44 - 0.75)	0.56 (0.42 - 0.74)
Alcohol Use within 2 Hours of Last CAI		
BMSMO	Ref.	Ref.
BMSMW	2.32 (1.62 - 3.33)	1.71 (1.18 - 2.49)
Time (1 Year Increase)	0.49 (0.38 - 0.64)	0.47 (0.36 - 0.62)
Receiving Money/Goods for Sex at Last CAI		
BMSMO	Ref.	Ref.
BMSMW	3.77 (2.27 - 6.27)	2.07 (1.23 - 3.48)
Time (1 Year Increase)	0.47 (0.28 - 0.78)	0.45 (0.27 - 0.76)
Giving Sex for Money/Goods at Last CAI		
BMSMO	Ref.	Ref.
BMSMW	2.47 (1.37 - 4.44)	1.40 (0.74 - 2.66)
Time (1 Year Increase)	0.58 (0.34 - 0.99)	0.53 (0.31 - 0.90)
Depression		
BMSMO	Ref.	Ref.
BMSMW	1.55 (1.28 - 1.89)	1.25 (1.00 - 1.56)
Time (1 Year Increase)	0.93 (0.81 - 1.09)	0.93 (0.80 - 1.09)
Internalized Homophobia		
BMSMO	Ref.	Ref.
BMSMW	1.60 (1.32 - 1.95)	1.65 (1.31 - 2.07)
Time (1 Year Increase)	0.77 (0.67 - 0.88)	0.76 (0.66 - 0.88)

*Interaction of the type of sexual partner and time was not statistically significant in all models and not included in the final models.

*Adjusted for age, education, income, employment status, housing stability, incarceration, study site and intervention group

ACCEPTED