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An event-level analysis of condomless anal intercourse with a HIV-discordant or HIV status- unknown partner among black men who have sex with men from a multi-site study

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Abstract

Despite the high HIV incidence and prevalence among black men who have sex with men (BMSM), little research has examined partner characteristics, partner seeking venue, sexual position, substance use, and sexual risk behavior at the sex event-level among BMSM. Using the baseline data from a multi-site study of 807 BMSM stratified by their HIV status, the goal of this study was to conduct a detailed event-level analysis of 1,577 male anal sex events to assess the factors associated with condomless anal intercourse (CLAI) with a HIV-discordant or HIV status-unknown partner. We found CLAI with an HIV-discordant or unknown HIV status partner among HIV-negative BMSM was negatively associated with having sex with a main partner, and was positively associated with taking both receptive and insertive sexual positions during sex. As compared to a sex partner met at bar, night club or dance club, HIV-positive BMSM were less likely to engage in CLAI with HIV-discordant and unknown HIV status partner met at party or

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Conflict of Interest: The authors declare that they have no conflict of interest.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention

Ethical approval

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

friend's house or at community organizations. HIV-positive BMSM had lower odds of engaging in CLAI with HIV-discordant and unknown HIV status partner if they had insertive sexual position or both receptive and insertive sexual positions. These results underscore the importance of delineating unique sex event-level factors associated with sexual risk behavior depending on individuals' HIV status. Our findings suggest event-level partner characteristics, sexual position, and partner seeking venues may contribute to disparities in HIV incidence.

Introduction

Based on the current HIV incidence rate in the US, about 1 in 2 black men who have sex with men (BMSM) will be diagnosed with HIV during their lifetime [1]. Studies show significant racial disparities in HIV, and BMSM have up to 4 times the risk of infection compared to white men who have sex with men (MSM) [2–4]. A growing body of literature has tried to explain the elevated rates of HIV among BMSM [5–7], but found prevalence of sexual risk behaviors using person-level measures (e.g., frequencies of a given behavior in a defined recall period) among BMSM is actually comparable to or lower than white MSM [5–9]. One possible explanation is the synergy of multiple risk factors in a specific sex event may confer higher HIV risk than the additive total of risk behaviors observed by person-level measures [10,11].

Event-level assessment provides specific information related to a specific sex event, such as partner characteristics, and allows for detailed assessment of how various factors are associated with condomless anal intercourse (CLAI) [12–17]. Research has suggested that characteristics of the sex partner at a specific sex event can be associated with disease transmission [18]. One way to examine partner characteristics is sexual mixing, i.e., the extent to which one's sex partners are similar to themselves (i.e., assortative mixing) or different from themselves (i.e., disassortative mixing) with regard to HIV status, race/ethnicity, or age [19]. Studies indicate BMSM tend to have race-concordant partners as compared to their white or other racial/ethnic minority peers [20–22]. Several studies have also suggest that, among young BMSM, having an older partner may be associated with increased likelihood of HIV risk behavior [8,11,20]. However, age difference between partners was not associated with condom use among MSM across racial and ethnic groups [12]. Sexual risk behaviors also vary depending on partnership type. An inverse relationship between level of relationship commitment and condom use has been observed in both heterosexual and homosexual relationships [23]. More specifically, research has found MSM are more likely to use condoms during anal intercourse with casual partners than with main partners [12].

Venues where MSM meet their partners can influence HIV risk behaviors by nature of the populations, norms, and risk behavior patterns at the venue [24]. For example, Grov et al. found that meeting a partner in public places, such as a park or outdoors, was associated with a reduced likelihood of knowing a partner's HIV status when compared to meeting a partner in a bar, club, event, or bathhouse. However, meeting a partner in a bar, club, event, or bathhouse was associated with a greater likelihood of using alcohol or other substances

before or during the sex event. Additionally, men who had met their partner online had the highest likelihood of knowing their partner's HIV serostatus [25].

Sexual positioning practice (i.e., receptive, insertive, or both) is also known to influence likelihood of HIV transmission [26]. Specifically, men who participate in receptive anal intercourse are more likely to acquire HIV compared to men who only participate insertive anal intercourse [27]. Individual and partner HIV status may affect sexual positioning and HIV prevention decision making. Studies suggest that in condomless anal intercourse between serodiscordant individuals, HIV-positive MSM more often take the receptive position than HIV-negative MSM [28]. An event-level analysis found BMSM reported greater condom use than white MSM in the insertive position [9].

Substance use (alcohol or other drugs) has been linked to high-risk sexual behaviors [29,30] and HIV prevalence [31,32]. Even light to moderate substance use can have a direct impact on risk behaviors by impairing judgment and cognition and by disinhibiting behavior, thereby potentially increasing the likelihood of condomless sex and other risky behaviors. Substance use during sex events may be intermittent (i.e., "recreational") and is not necessarily associated with chronic substance use or substance use dependence [33]; thus, event-level analyses have particular utility for examining the association of substance use with sexual risk behavior. A review of the literature on event-level substance use and sexual risk behavior among MSM identified a consistent association between sexual risk behaviors and methamphetamine use and alcohol binge drinking [34]. Among MSM across different races or ethnicities and among BMSM more specifically, existing evidence with event-level data has indicated associations between substance use and sexual risks such as CLAI with HIV serodiscordant partners, CLAI with casual partners, and group sex [10,13,33,35].

Event-level assessment of sexual risk behavior may offer an alternative approach to better understand the elevated HIV incidence and prevalence among BMSM. However, little of the existing research using an event-level approach has been conducted among BMSM [14]. The goal of this study was to contribute to the existing literature on event-level factors associated with sexual risk behavior among a sample of BMSM from a multi-site study. Risk for contracting or transmitting HIV infection is the greatest when engaging in CLAI with a HIV discordant or HIV status-unknown partner [14]. Therefore, we focused on event-level factors associated with CLAI with a HIV discordant or status-unknown partner. We hypothesized that CLAI with a HIV discordant or status-unknown partner will be more likely to occur when having anal intercourse with a main or disassortative mixing partner, or sex under the influence of alcohol or drugs. For HIV-negative BMSM, insertive sexual position will be positively associated with CLAI with a HIV discordant or status-unknown partner. For HIV-positive or HIV status-unknown BMSM, receptive sexual position will be positively associated with CLAI with a HIV discordant or status-unknown partner.

Method

We analyzed baseline data from the Latino and African American Men's Project (LAAMP), a CDC-funded multi-site project. Four sites (Baltimore, Chicago, greater Milwaukee /greater Detroit region (GMDR), and New York City) enrolled BMSM in their intervention studies.

Baseline data were collected from 2008 to 2009. Institutional review boards at each of the study locations and the Centers for Disease Control and Prevention approved the questionnaire, data collection and study procedures.

Recruitment

BMSM were recruited from gay bars, dance clubs, house parties, gay chatrooms, college campuses, health departments, and community-based organizations that provide services to this population. Additional methods included referrals from study participants and service providers, the placement of recruitment materials (e.g., flyers and study cards) at locations frequented by BMSM, and the placement of ads in local gay magazines and newspapers.

A brief screening was conducted to identify eligible men for the studies. Eligibility criteria across the four studies included being at least 18 years of age, identifying as African American or black, having at least 2 sexual partners in the past 3 months (at least 1 of whom must have been male), engaging in condomless anal sex with a man in the past three months, and willingness to take an HIV test. Participants were ineligible to participate if they identified as transgender, or did not reside in the cities where the interventions were occurring.

At the baseline visit, participants reconfirmed eligibility and provided written informed consent. Participants completed a behavioral assessment using audio computer-assisted self-interview (ACASI) technology. Following completion of the assessment, all participants received HIV risk-reduction counseling. A rapid HIV antibody test was conducted if participants self-reported being HIV-negative or did not know their current HIV status. Preliminary positive rapid test results at the baseline visit were confirmed by Western blot testing. Newly diagnosed persons were referred to medical and social services. Participants who reported being HIV-positive did not undergo HIV testing if they were able to provide documentation of their HIV-positive status. Reimbursement for participation (time and expenses) was determined by each site.

Measures

Individual sociodemographic and behavioral covariates—Sociodemographic characteristics measured included age, education, and current employment status. Participants reported their sexual identity by choosing from one of the following categories: “heterosexual or straight,” “bisexual,” “queer,” “homosexual or gay,” “not sure/questioning,” or “other.” Participants were asked to report the result of their most recent HIV test. For participants who never had an HIV test, their HIV status was coded as “unknown.”

Participants reported the frequency of alcohol use and the frequency of heavy episodic drinking by answering two questions from the Alcohol Use Disorders Identification (AUDIT) questionnaire [36]: “Thinking about the last 3 months, how often did you have a drink containing alcohol?” and “Over the last 3 months, how often did you have six or more drinks on one occasion?” Binary variables of drinking alcohol at least twice a week and heavy episodic drinking at least weekly were constructed for the analysis. Participants also reported whether they had used crack, cocaine, or methamphetamine over the last 3 months.

Event-level measures

Sex events: Each participant was asked to nominate up to three male sex partners he “most recently had anal sex with in the last 3 months,” and to provide details on the last anal sex event with each sex partner.

Partner characteristics: Based on participants’ responses, a list of questions was asked to assess each partner’s characteristics, including age, partner type (main partner or not), and race/ethnicity. Disassortative age mixing was operationalized as more than 5 years difference between participant and sex partner’s age (i.e., sex partner is either at least 5 years younger or at least 5 years older than the participant). Perceived partner HIV status was assessed by a question “What is his HIV status?” with choices of “You believe he is HIV-positive,” “You believe he is HIV-negative,” and “You do not know or are unsure about his HIV status.” A constructed variable of HIV-discordant or unknown HIV status partner was derived from measures of participant’s report of his own HIV status and perceived partners’ HIV status.

Partner seeking venues: Participants were asked how they met each partner with 10 choices: 1) bar/night club/dance club, 2) internet, 3) party or friend’s house, 4) work or school, 5) street festival, pride parade, circuit party, 6) community organization, 7) health club or gym, sex club, bathhouse, porn theater/video arcade, or bookstore, 8) telephone chat line, 9) other public place, such as the beach or a park, and 10) other non-public place.

Sexual position: Participants indicated their own sexual position during the last sex event with each partner as “top,” “bottom,” or both positions.

Substance use: In reference to the last time the participant had anal sex with each partner, the following questions were asked: “Were you buzzed or drunk from alcohol?” “Was he buzzed or drunk from alcohol?” “Did you use any drugs?” “Did he use any drugs?” The sex event was characterized as “sex under the influence of alcohol” or “sex under the influence of drugs.”

Condom use: Participants were asked about condom use during the last sex event with each partner by two questions: “The last time you had anal sex with [partner], did you use a condom from start to finish (if you were the top at any time)?” and “The last time you had anal sex with [partner], did [partner] use a condom from start to finish (if you were the bottom at any time)?”

Sexual risk behavior outcome

CLAI with HIV-discordant or unknown HIV status partner was derived from measures of a participant’s report of his own HIV status, perceived partners’ HIV status, and occurrence of condomless insertive or receptive anal intercourse during the last sex event with each partner.

Data analysis

The current analysis focuses on the last sex event with a male sex partner among 807 BMSM stratified by individual’s HIV status. Logistic regression models using each sex

event as the unit of analysis were conducted to assess the associations between individual characteristics, partner characteristics, partner seeking venue, sexual position, substance use during the sex event, and the outcomes of CLAI with an HIV-discordant or unknown HIV status partner. We used generalized estimating equations (GEE) [37] to account for the fact that individuals reported multiple sex events, to allow specification of the within-group correlation structure for the same participant. Variables that were associated with outcomes in the bivariate models ($p < 0.10$) were entered into a multivariate model. All analyses were performed using Stata Version 14.0 (College Station, TX).

Results

Participant sociodemographic and behavioral characteristics

Sociodemographic and behavioral characteristics of 807 participants stratified by HIV status are presented in Table 1. As compared to HIV-negative participants, HIV-positive or HIV status-unknown participants were older, less likely to work part time or full time, more likely to self-identified as “gay,” and more likely to have used cocaine, crack, or methamphetamine in the past 3 months.

Sex event characteristics

A total of 1,577 sex events were reported by the 807 BSM participants—73 participants reported one sex event; 698 participants reported two sex events, and 36 reported three sex events. Characteristics of sexual partners in 1,577 sex events stratified by participants' HIV status are presented in Table 1. As compared to HIV-negative participants, sex events among HIV-positive or HIV status-unknown participants were likely to be disassortative age mixing, with a HIV serodiscordant or status-unknown partner, HIV-positive or HIV status-unknown participants taking a receptive sexual position, and under the influence of drug or alcohol.

Unadjusted and adjusted multivariate logistic models stratified by HIV status

Results of unadjusted and adjusted multivariate logistic regression models with GEE for CLAI with an HIV-discordant or unknown HIV status partner stratified by participant's HIV status are presented in Table 2. Among HIV-negative participants, individuals who used crack, cocaine, or methamphetamine had higher odds of engaging in CLAI with an HIV-discordant or unknown HIV status partner than those not reporting the use of these drugs (AOR: 1.67, 95% CI: 1.02, 2.72). HIV-negative participants had lower odds of engaging in CLAI with an HIV-discordant or unknown HIV status partner who was a main partner than who was a non-main partner (AOR: 0.59, 95% CI: 0.39, 0.87). Compared to those only taking receptive sexual position during a sex event, HIV-negative participants had higher odds of engaging in CLAI with HIV-discordant and unknown HIV status partner if they had both receptive and insertive sexual positions (AOR: 1.88, 95% CI: 1.10, 3.21).

Among HIV-positive or HIV status-unknown participants, individuals who had heavy episodic drinking at least weekly were more likely to engage in CLAI with an HIV-discordant or unknown HIV status partner than those with heavy episodic drinking less frequently (AOR: 1.71, 95% CI: 1.11, 2.64). As compared to a sex partner met at bar, night

club, or dance club, HIV-positive participants were less likely to engage in CLAI with a HIV-discordant and unknown HIV status partner met at party or friend's house (AOR: 0.46, 95% CI: 0.25, 0.76) or at community organizations (AOR: 0.34, 95% CI: 0.19, 0.62). Compared to those only taking receptive sexual position during a sex event, HIV-positive participants had lower odds of engaging in CLAI with HIV-discordant or unknown HIV status partner if they had insertive sexual position only (AOR: 0.59, 95% CI: 0.41, 0.84) or both receptive and insertive sexual positions (AOR: 0.62, 95% CI: 0.41, 0.92). Sex under the influence of alcohol or drugs was not associated with CLAI with an HIV-discordant or unknown HIV status partner among both HIV-negative and HIV-positive participants.

Discussion

Using event-level data from a sample of BMSM from a multi-site study, we found that CLAI with an HIV-discordant or unknown HIV status partner was associated with different sex event-level factors among HIV-negative and HIV-positive or status-unknown BMSM. These results underscore the importance of delineating contextual factors surrounding individual sex events. The results may also be helpful for informing outreach strategies and HIV prevention messages for BMSM.

In this sample of BMSM, 32% of sex events occurred with a partner whose HIV status was unknown or the participant being unsure of the partner's status, and the rate was significantly higher among HIV-positive or HIV status-unknown participants (37%) than HIV-negative participants (26%). This finding is consistent with another event-level analysis with BMSM from Milwaukee, Cleveland, and Miami where nearly a third of BMSM did not know their partner's HIV status [14]. There are two potential explanations. First, there is an alarmingly high proportion of seropositive BMSM unaware of their HIV status [38]. A National HIV Behavioral Surveillance (NHBS) survey in 2011 found 71% of HIV-positive BMSM in Baltimore area reported that they were unaware of their HIV status [39]. Second, the high prevalence of anal sex events with HIV status-unknown sex partners may reflect limited disclosure of HIV-positive serostatus, attributable to fears of stigmatized identity, social rejection and isolation, and interpersonal violence [40–42].

We found over half of the sex events (53%) occurred with a disassortative age mixing partner, similar to high prevalence of disassortative age mixing patterns among BMSM observed in previous research [8,11,20]. A Baltimore-based qualitative study suggested that BMSM aged 16–24 years may intentionally seek out older sex partners in order to fulfill desires for emotional, structural, and financial stability, exposure to the larger MSM community, and guidance in sexual experience [43]. Although disassortative age mixing was not significantly associated with the sexual risk behavior outcome in the present study, disassortative age mixing can introduce power differentials that may place young MSM at an increased risk of sexual coercion or forced anal sex [44]. Disassortative age mixing also confers additional HIV risk, given elevated HIV prevalence among older MSM [45]. In addition to partner age, we found that partnership type was associated sexual risk behavior. More specifically, HIV-negative participants had lower odds of engaging in CLAI with an HIV-discordant or unknown HIV status partner who was a main partner than who was a non-

main partner, which may be due to a better knowledge of HIV status in a committed relationship and not wanting to transmit the HIV virus.

In this sample of BMSM, 13% of sex events occurred with a partner first met via the internet. There have been mixed findings among MSM in the US and around the world on the association between internet sex-seeking and engaging in high risk sexual behaviors [46–50]. In this study, we did not observe a significant association between CLAI with a partner met via the internet when compared to meeting a partner at a bar/night club/dance club among both HIV-negative and HIV-positive or status-unknown individuals. Our finding adds to the growing body of literature that suggests meeting a partner online is not necessarily associated with increased sexual risk [25,34,51]. We also found HIV-positive or HIV status-unknown BMSM were significantly less likely to have CLAI with an HIV-discordant or unknown HIV status partner they met at party or friend's house or community organization as compared to partners met bars/night clubs/dance clubs. More studies are needed to explore physical or social characteristics, and sex networks within certain physical or virtual spaces.

We found HIV-positive or status-unknown participants were more likely to take the receptive sexual position than HIV-negative participants, and event-level sexual position was significantly associated with sexual risk behaviors. More specifically, there was a higher odds of CLAI with an HIV-discordant or unknown HIV status partner among HIV-negative BMSM who took both receptive and insertive sexual positions than those who only took a receptive sexual position. Compared to those only taking receptive sexual position during the sex event, HIV-positive or status-unknown participants had lower odds of engaging in CLAI with HIV-discordant or unknown HIV status partner if they only took insertive sexual position or took both receptive and insertive sexual positions. The findings may suggest an act of “strategic positioning” or “seropositioning” as individuals may choose a different sexual position depending on the serostatus of the sexual partner to prevent HIV transmission [52]. A systematic review on sexual positioning among MSM indicated 6% to 13% of MSM explicitly practice seropositioning [26]. However, the present study did not assess whether or not participants engaged in strategic positioning as potential risk reduction strategies nor whether sexual behavior practices were a result of planned decision-making in relation to concordance or discordance. Issues of seropositioning among BMSM have received some attention [7,53,54] but will require more studies to explore how sexual positioning intersects with factors such as HIV status, partner characteristics, power dynamics, and other relevant processes [26]. Informed by a better understanding of seropositioning among BMSM, HIV-prevention messaging should recognize the psychosocial context of sexual practice while communicating risks associated with positioning preferences.

In this sample of BMSM, cocaine, crack, or methamphetamine use in the past 3 months was significantly associated with CLAI among HIV-negative BMSM, and frequent heavy episodic drinking was significantly associated with CLAI among HIV-positive or HIV status-unknown BMSM. However, no association was found between CLAI and sex under the influence of alcohol or drugs in the multivariate analysis. Previous meta-analyses of studies with both MSM and heterosexual participants also failed to definitively support a

direct influence of substance use on sexual risk behavior [34,51]. The association between alcohol or drug use and CLAI may be moderated by outcome expectancy [55], or individual belief that substance use lowers sexual inhibitions and increases risks for engaging in CLAI. This calls attention to the importance of recognizing and addressing different types of drugs in the context of sex and the quantity of alcohol use that may increase sexual risk-taking among MSM.

Limitations of this study should be noted. The current study utilized data from a multi-site study, representing urban cities in the Northeast and Midwest. These findings may not be generalizable to other locations where BMSM reside. Lack of data on recruitment response rates is another significant limitation on generalizability due to the selection bias. However, many of the findings from this study are comparable to previous research of event-level analyses with BMSM [14]. The study also relied on participants' reports of their behavior, which are subject to recall and social desirability bias [56]. Finally, the analyses focused on the last sex events with the most recent sex partners, and therefore, partner characteristics, substance use, and risky sexual behaviors may not necessarily be representative of overall patterns of sexual behaviors.

Despite these limitations, findings from the current study can inform future research and intervention development with BMSM, the population most disproportionately affected by HIV. More research is needed for a better understanding of the influence of partner characteristics, sexual position, and availability and access to certain partner seeking venues, including internet websites and social-networking mobile applications, on HIV risk among BMSM.

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Table 1

Socio-demographic and behavioral characteristics of the 807 Black men who have sex with men (BMSM) (LAAMP Study: Baltimore, Chicago, Greater Milwaukee /Greater Detroit Region, and New York City, 2008–2009)

	All participants (n=807)	HIV negative (n=350)	HIV positive or unknown HIV status (n=457)	p-value
Participant individual characteristics				
Site				
Chicago	204 (25%)	93(27%)	111(24%)	
Baltimore	177 (22%)	81(23%)	98(21%)	
Greater Milwaukee/Detroit region (GMDR)	147 (18%)	71(20%)	76(17%)	
New York	279 (35%)	105(30%)	174(38%)	0.11
Age (years): mean (range)	37 (18–68)	34(18–63)	40(18–68)	
18–24	148 (18%)	107(31%)	41(9%)	
25–34	138 (17%)	69(20%)	69(15%)	
35–44	261 (33%)	88(25%)	173(38%)	
45 or older	260 (32%)	86(25%)	174(38%)	<.001
Education: at least college, associates or technical degree	360 (45%)	156(45%)	204(45%)	0.99
Working part/full time	228 (28%)	138(39%)	90(20%)	<.001
Self-reported sex identity				
Gay	506 (63%)	193(55%)	313(69%)	
Straight	32 (4%)	22(6%)	10(2%)	
Bisexual	237 (29%)	121(35%)	116(25%)	
Others or not sure	32 (4%)	14(4%)	18(4%)	<.001
Self-reported HIV status				
Negative	350 (43%)			
Unknown	81 (10%)			
Positive	376 (47%)			
Drink at least twice a week	298 (37%)	140(40%)	158(35%)	0.11
Heavy episodic drinking at least weekly in the past 3 months	140 (17%)	63(18%)	77(17%)	0.67
Have used cocaine/crack/meth in the past 3 months	322 (40%)	113(32%)	209(46%)	<.001
Last anal sex event with 3 recent male sex partners	n=1577	n=677	n=899	
Partner’s characteristics				
Perceived partner age: mean (range)	35 (16–70)	32(16–70)	37(17–65)	

	All participants (n=807)	HIV negative (n=350)	HIV positive or unknown HIV status (n=457)	p-value
24 or younger	326 (21%)	211(31%)	115(13%)	
25–34	448 (28%)	200(30%)	248(28%)	
35–44	456 (29%)	164(24%)	292(32%)	
45 or older	347 (22%)	103(15%)	244(27%)	<.001
Age mixing				
Same age (<=5 years younger or older)	747 (47%)	347(51%)	400(44%)	
Age >5 years difference between participant and partner	830 (53%)	331(49%)	499(56%)	0.008
Main partner				
Same race as partner	1270 (81%)	540(80%)	730(81%)	0.41
Perceived partner’s HIV status				
Believe he is positive	442 (28%)	47(7%)	395(44%)	
Believe he is negative	627 (40%)	453(67%)	174(19%)	
Don’t Know or Unsure	507 (32%)	177(26%)	339(37%)	<.001
HIV status concordance				
Concordant	833(53%)	453(67%)	380(42%)	
Discordant or unknown	744 (47%)	225(33%)	519(58%)	<.001
Partner seeking Venues				
Where first met				
Bar/night club/dance club	238(15%)	118(17%)	120(13%)	
Internet	212(13%)	95(14%)	117(13%)	
Party or friend’s house	329(21%)	148(22%)	181(20%)	
Work or school	74(5%)	40(6%)	34(4%)	
Street festival, pride parade, Circuit party	64(4%)	28(4%)	36(4%)	
Community organization	162(10%)	41(6%)	121(13%)	
Health club or gym, Sex club, bathhouse, porn theater/video arcade, or bookstore	69(4%)	34(5%)	35(4%)	
Telephone chat line	82(5%)	35(5%)	47(5%)	
Other public place, such as beach or park	223(14%)	85(13%)	138(15%)	
Other non-public place	124(8%)	54(8%)	70(8%)	<.001
Sex position				
Receptive only	484(31%)	178(26%)	306(34%)	
Insertive only	729(46%)	364(54%)	365(41%)	
Both receptive and insertive	358(23%)	135(20%)	223(25%)	<.001
Substance use during last sexual event				

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	All participants (n=807)	HIV negative (n=350)	HIV positive or unknown HIV status (n=457)	p-value
Sex under the influence of drug	562(36%)	194(29%)	368(41%)	<.001
Sex under the influence of alcohol	883(56%)	347(51%)	536(60%)	.001
Behavioral outcome of interest				
Condomless anal intercourse (CLAI) with an HIV-discordant or unknown HIV status partner	503 (32%)	151(22%)	352(39%)	<.001

Values not reflecting column totals for some variables due to missing data

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Table 2

Unadjusted and Adjusted Logistic Regression Models with Generalized Estimating Equations for Condomless Anal Intercourse (CLAI) with an HIV-discordant or Unknown HIV Status Partner of BMSM (LAAMP Study: Baltimore, Chicago, Greater Milwaukee /Greater Detroit Region, and New York City, 2008–2009)

	Sex events among HIV negative (n=677)		Sex events among HIV positive or unknown HIV status (n=899)	
	Unadjusted analysis	Adjusted Analysis	Unadjusted analysis	Adjusted Analysis
Participant individual characteristics	UOR [95%CI]	AOR [95%CI]	UOR [95%CI]	AOR [95%CI]
Site				
Chicago	Ref		Ref	Ref
Baltimore	0.96(0.52,1.77)		1.01(0.63,1.61)	1.00(0.61,1.67)
Greater Milwaukee/Detroit region	1.45(0.83,2.68)		2.51(1.51,4.18)***	2.89(1.68,4.96)***
New York	1.42(0.83,2.44)		0.78(0.52,1.17)	0.87(0.57,1.32)
Education				
Less than college, associate or technical degree	Ref		Ref	
At least college, associates or technical degree	0.97(0.64,1.48)		0.83(0.60,1.14)	
Employment				
Not working part/full/time	Ref	Ref	Ref	
Working part/full time	0.59(0.36, 0.86)**	0.65(0.41,1.04) ⁺	1.39(0.94,2.06) ⁺	
Self-reported sex identity				
Gay	Ref		Ref	
Straight	1.85(0.77,4.41)		0.72(0.27,1.92)	
Bisexual	1.05(0.66,1.67)		1.05(0.71,1.54)	
Others or not sure	1.59(0.65,3.87)		0.84(0.36,1.98)	
Alcohol use				
Drink less twice a week	Ref	Ref	Ref	
Drink at least twice a week	1.59(1.05,2.43)*	1.39(0.88,2.22)	1.16(0.83,1.61)	
Heavy episodic drinking in the past 3 months				
Less than weekly	Ref		Ref	Ref
At least weekly	0.91(0.51,1.59)		1.70(1.12,2.57)*	1.71(1.11,2.64)*
Cocaine/crack/meth use in the past 3 months				
No	Ref		Ref	
Yes	2.04(1.32,3.15)**	1.67(1.02,2.72)*	1.17(0.85,1.61)	
Partner characteristics				
Age mixing				

	Sex events among HIV negative (n=677)		Sex events among HIV positive or unknown HIV status (n=899)	
	Unadjusted analysis	Adjusted Analysis	Unadjusted analysis	Adjusted Analysis
	UOR [95%CI]	AOR [95%CI]	UOR [95%CI]	AOR [95%CI]
Participant individual characteristics				
Same age (<=5 years younger or older)	Ref		Ref	Ref
Age >5 years different between participant and partner	1.27(0.91,1.78)		1.33(1.04,1.71) *	1.25(0.95,1.64)
Partner type				
Non-main partner	Ref	Ref	Ref	Ref
Main partner	0.60(0.41,0.87) **	0.59(0.39,0.87) **	0.74(0.56,0.96) *	0.80(0.59,1.08)
Race of the partner				
Not same	Ref		Ref	
Same race	1.03(0.64,1.66)		0.83(0.60,1.14)	
Partner seeking venues				
Bar/night club/dance club	Ref	Ref	Ref	Ref
Internet	0.72(0.37,1.39)	0.94(0.47,1.90)	0.92(0.55,1.55)	1.08(0.62,1.86)
Party or friend's house	0.74(0.43,1.30)	0.73(0.40,1.31)	0.46(0.28,0.75) **	0.44(0.25,0.76) *
Work or school	0.55(0.23,1.31)	0.62(0.23,1.62)	0.72(0.35,1.50)	0.77(0.36,1.64)
Street festival, pride parade, Circuit party	1.18(0.47,2.95)	1.23(0.44,3.41)	1.07(0.54,2.12)	1.21(0.58,2.54)
Community organization	0.83(0.37,1.89)	0.89(0.37,2.13)	0.30(0.17,0.51) ***	0.34(0.19,0.62) ***
Health club/gym/sex club/bathhouse/porn theater/video arcade/bookstore	2.13(0.95,4.77) †	2.00(0.88,4.56) †	1.15(0.51,2.57)	1.41(0.63,3.18)
Telephone chat line	0.80(0.32,2.02)	0.77(0.29,2.02)	0.71(0.36,1.42)	0.76(0.37,1.58)
Other public place, such as beach or park	0.97(0.50,1.87)	0.95(0.47,1.92)	1.37(0.84,2.53)	1.51(0.89,2.57)
Other non-public place	1.34(0.63,2.85)	1.52(0.61,1.54)	0.70(0.36,1.36)	0.75(0.38,1.49)
Sex position				
Receptive only	Ref	Ref	Ref	Ref
Insertive only	1.12(0.73,1.72)	0.97(0.61,1.54)	0.62(0.44,0.87) **	0.59(0.41, 0.84) **
Both receptive and insertive	1.77(1.10,2.84) *	1.88(1.10,3.21) *	0.65(0.45,0.95) *	0.62(0.41,0.92) *
Substance use during sex				
Sex not under the influence of drug				
No	Ref		Ref	
Yes	1.39(0.92,2.10)		1.10(0.81,1.49)	
Sex not under the influence of alcohol				
No	Ref	Ref	Ref	
Yes	1.50(1.04,2.14) *	1.19(0.79,1.81)	1.09(0.82,1.43)	

† p<.10.

*
p<.05,

**
p<.01,

p<.001

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