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# Disclosure of HIV Status and HIV Sexual Transmission Behaviors among HIV-Positive Black Men Who Have Sex with Men in the BROTHERS (HPTN 061) Study

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**Abstract** We assessed whether disclosure of HIV status is significantly associated with reported HIV sexual risk behaviors among HIV positive Black/African American men who have sex with men (MSM) (Black MSM) in six cities in the USA. Participants from the BROTHERS (HIV Prevention Trials Network [HPTN 061]) study focused on assessing the feasibility and acceptability of a multifaceted HIV prevention intervention to reduce HIV infections among Black MSM enrolled between July 2009 and October 2010. All participants completed a behavioral assessment using an audio computer-assisted self-interview that

included questions about HIV status disclosure, HIV sexual risk behaviors, and other behaviors. Biological samples were also collected. This analysis focused on baseline data of HIV-positive Black MSM in the HPTN 061 study. Of the 143 HIV-positive Black MSM (majority  $\geq 35$  years of age) included in this analysis, 58% reported disclosing their HIV status to their last male anal sex partner. Forty-three percent and 42% reported condomless insertive and receptive anal intercourse respectively with their last male partner; whereas, 17% and 18% of the sample engaged in condomless insertive and receptive anal intercourse with a serodiscordant/unknown status partner, respectively. In multivariable logistic regression models, there was no statistically significant association between HIV status disclosure and condomless insertive anal intercourse (aOR = 0.35, 95% CI 0.11, 1.08;  $p = 0.30$ ), condomless receptive anal intercourse (aOR = 2.48, 95% CI 0.94, 6.52;  $p = 0.20$ ), or condomless receptive anal intercourse with a serodiscordant/unknown status partner (aOR = 0.55, 95% CI 0.20, 1.49;  $p = 0.45$ ). However, HIV status disclosure was significantly associated with lower odds of reporting condomless insertive anal intercourse with a serodiscordant/unknown status partner (aOR = 0.19, 95% CI 0.06, 0.68;  $p \leq 0.01$ ). Among this multi-city sample of HIV-positive Black MSM, disclosure of HIV status was common and associated with lower HIV sexual risk behaviors. These findings should motivate and guide research to develop prevention messages to increase HIV status disclosures.

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## Introduction

Men who have sex with men (MSM), particularly, Black/African American MSM (Black MSM) remain disproportionately affected by HIV infection in the USA. In 2017, Black MSM accounted for the largest proportion of new HIV diagnoses (40%) relative to Hispanic (30%) or White (28%) MSM in the USA [1]. The high HIV prevalence among Black MSM, disparities in social determinants of health, HIV treatment outcomes (specifically viral load suppression), and sexual networks increase HIV transmission potential among Black MSM [2–4]. As such, the ongoing high HIV incidence rates among MSM, but particularly Black MSM, have necessitated the development and implementation of a range of HIV prevention approaches including those that are biomedically based (e.g., pre-exposure prophylaxis [PrEP]) [5, 6], behavioral efforts [7, 8], and combination interventions [9].

HIV transmission among MSM is predominantly due to condomless anal intercourse (CAI), given the enhanced susceptibility of rectal mucosa to HIV. MSM often engage in a variety of risk reduction strategies to decrease their risk of HIV transmission. For example, serosorting involves selecting sexual partners based on one's own HIV status in order to engage in CAI but to limit serodiscordant sex [10]. However, the impact of serosorting on decreasing the risk of acquiring HIV depends on accurate knowledge and disclosure of HIV status of the individual and their sexual partner. Furthermore, disclosure of HIV status to sex partners (hereon referred to as disclosure of HIV status) among HIV-positive MSM can be an important HIV risk reduction strategy, as it can provide an opportunity for communication between sexual partners about HIV risk behaviors and prevention approaches such as condom use during anal intercourse and or the use of PrEP [10, 11]. Sexual risk reduction strategies among Black MSM living with HIV can help reduce HIV transmission to HIV-negative sexual partners as well as reduce the risk of HIV superinfection due to reinfection with a second strain of virus [12]. Accordingly, several studies have found associations between disclosure of HIV status and lower sexual risk behaviors among MSM [13–15]. Among HIV-positive MSM, studies have shown that disclosure of HIV status to some or all sex partners is associated with an increase in condom use during both oral and anal sex [14] as well as lower CAI with serodiscordant partners [16]. However, a few studies have not found any

significant relationship between disclosure of HIV status and lower HIV sexual risk behaviors among HIV-positive MSM [17, 18], indicating that additional investigation into the relationship between disclosure of HIV status and HIV sexual risk behaviors is warranted.

Disclosure of HIV status is a complex process that may differ with each type of sexual partner, with disclosure being more likely with a primary partner than a casual partner [19]. However, some studies of disclosure and HIV sexual risk behaviors do not account for partnership type [13, 14, 18]. There are also some indications that the process of disclosure of HIV status among MSM differs by racial/ethnicity. For instance, studies show that Black MSM are less likely to disclose their HIV status when compared with white MSM [13, 20, 21]. Yet, few studies have specifically focused on the topic of disclosure of HIV status and HIV sexual risk behaviors among HIV-positive Black MSM. To this end, the objective of this analysis is to determine whether disclosure of HIV status is significantly associated with reported HIV sexual risk behaviors among HIV-positive Black/African American MSM in six cities in the USA. We hypothesized that disclosure of HIV status would be associated with decreased reported HIV sexual risk behaviors among HIV-positive Black MSM.

## Methods

### Study Participants

Data for this secondary analysis comes from the BROTHERS (HIV Prevention Trials Network [HPTN 061]) study. Additional details about the HPTN 061 have previously been published [22]. Briefly, the goal of the HPTN 061 study was to determine the feasibility and acceptability of a multifaceted HIV prevention intervention to reduce HIV infections in Black MSM in six US cities: Atlanta, New York, Washington DC, Boston, Los Angeles, and San Francisco. Between July 2009 and October 2010, prior to the US Food and Drug Administration (FDA) approval in 2012 of the use of Truvada as PrEP, Black MSM were recruited directly from the community or as sexual network partners referred by index participants, who were identified as those who might be part of high-risk networks. Community recruitment methods included direct field-based outreach, engagements of key informants and community groups, advertising through various print and online

media, and the use of chat room outreach and social networking sites. Participants were eligible if they were born male, were self-identified as Black, African American, Caribbean Black, or multiethnic Black, and have at least one self-reported episode of condomless anal sex with a man in the prior 6 months. The study enrolled 1553 participants at baseline and were classified as HIV-negative, newly diagnosed, or previously diagnosed based on confirmed HIV status at enrollment and whether they already knew they were HIV-positive. For participants with low or undetectable HIV viral loads who did not report a prior HIV diagnosis, enrollment samples were retrospectively tested for the presence of antiretroviral drugs; men whose samples contained antiretroviral drugs indicative of antiretroviral therapy (ART) were considered to be previously diagnosed [23]. The current analysis was limited to previously diagnosed HIV-positive Black MSM, who reported a prior HIV diagnosis ( $N = 143$ ). Institutional review boards at all sites approved the study.

### Study Procedures

Eligible participants attended a baseline enrollment visit and two subsequent follow-up visits that occurred 6 and 12 months after the enrollment visits [22]. Participants provided demographic information at the enrollment visit during an interviewer-administered questionnaire. At every visit, participants completed a behavioral assessment using audio computer-assisted self-interview (ACASI). The current analysis includes baseline data from HIV-positive participants only.

### Measures

#### *Independent Variable*

*Disclosure of HIV status* The main independent variable was disclosure of HIV status to last anal sex partner. Participants were asked the following question with regard to the last time they had anal sex with a man in the past 6 months. “Did you discuss your HIV status with this person before you had sex?” The response options included (1) yes, I told him I was HIV positive; (2) yes, I told him I was HIV negative; (3) yes, I told him I did not know my HIV status; and (4) no, I did not discuss it with him. Using these responses, we dichotomized the disclosure of HIV status variable as 1 = yes, I told him I was positive and 0 = no, I did not discuss it

with him. Participants that indicated other response options were excluded from the analysis.

#### *Dependent Variable*

*HIV Sexual Risk Behavior* Separate questions in the ACASI assessed the most recent male anal sex partner in the last 6 months, the partner’s HIV status, whether they were the top (insertive) or bottom (receptive) and whether or not they used a condom. Using responses to these questions, we created four composite dichotomous (yes/no) variables including condomless insertive anal sex, condomless receptive anal sex, condomless insertive anal sex with a serodiscordant/unknown status partner, and condomless receptive anal sex with a serodiscordant/unknown status partner.

#### *Covariates*

*Sociodemographic Variables* At baseline, participants were asked questions about their date of birth (continuous age), education, income, and incarceration history. Study site locations included the city where participants were recruited.

*Partnership Type* Participants were asked whether their most recent male anal sex partner in the past 6 months was their primary/main, steady, casual exchange/trade, or anonymous partner. We created a dichotomous variable categorizing primary/main responses into one category and all other partnership types as others.

*Sexual Behavior* In two separate questions, participants reported the number of men and women they had sex within the last 6 months. Using responses to these questions, we created a dichotomous variable, with one category as men who have sex with men only (MSMO) if they reported sex with at least one man and no woman and a second category as men who have sex with men and women (MSMW) if they reported sex with at least a man and a woman.

*HIV Treatment Optimism* HIV treatment optimism was measured using two questions that asked participants to report their level of comfort with having unprotected sex because of their optimism regarding HIV treatment. Specifically, participants responded on a 5-point Likert scale from disagree to agree to [1] I feel comfortable having unprotected sex because treatments for HIV will

continue to improve and [2] I feel comfortable having unprotected sex because HIV can be easily managed now. Participants were categorized as having reduced treatment optimism if they somewhat agreed or agreed with one of the two items, as has been previously defined [24, 25].

*Internalized Homophobia* Participants completed a 7-item 5-point Likert scale ranging from “strongly disagree” to “strongly agree” to assess internalized homophobia [26, 27]. Sample questions included “I have tried to stop being attracted to men”; “If someone offered me the chance to be completely heterosexual, I would accept the chance”; and I wish I were not attracted to men. Scoring involved summing the items (possible range 7–35) and categorizing summed scores as low ( $\leq 16$ ), medium (17–26), and high ( $\geq 27$ ) internalized homophobia [28].

*Depression Symptoms* The Center for Epidemiologic Studies Depression (CES-D) scale was used to measure significant symptoms of depression [29]. This assessment was developed for use with community populations and includes components of depressed mood, feelings of worthlessness, sense of hopelessness, sleep disturbance, loss of appetite, and concentration difficulties. Scores on the CES-D of 16 or more suggests a clinically significant level of psychological distress [29].

*Intimate partner violence* Participants were asked four questions about whether they have experienced emotional abuse, physical abuse, being pressured, forced, or intimidated into doing something sexually or stalked by an intimate male partner. We created a composite dichotomous variable (yes/no) of whether men reported at least one instance of these four experiences [28, 30].

*Experience with Religion/Spiritual Services* We used a single question to assess participant’s experience with religion. Participants were asked how often they attended religious or spiritual services, with the following response options: never, holidays, monthly, weekly, or daily. We created a binary (yes/no) variable of whether participants attended religious or spiritual services or not.

*Substance use* Any substance use within 2 h before/after unprotected anal sex with a man. Participants responded to a series of yes/no questions on whether they used alcohol, marijuana, crack cocaine, or powder cocaine within 2 h of engaging in unprotected anal sex

with a man in the last 6 months. Using their responses, we created a composite dichotomous variable (yes/no) of whether participants used any substance within 2 h before/after unprotected anal sex with a man. A separate question asked participants whether in the last time they had anal sex with a man whether (yes/no) they were buzzed or drunk on alcohol.

#### *HIV care indicators*

*Prescribed ART and Viral Suppression* Participants were asked whether their doctor had prescribed pills to treat their HIV (yes/no). Participant’s plasma samples were used to quantify HIV RNA. Participants were defined as virally suppressed if their HIV RNA was less than 200 copies/ml at baseline.

#### Data Analysis

We computed descriptive statistics, including frequencies and percentages for each of the variables, and used chi-square/Fischer’s exact test to compare the distribution of the dependent variable and covariates by disclosure of HIV status. We used a series of bivariable and multivariable logistic regression models to determine the relationships between disclosure of HIV status and each of the four dependent variables. In constructing the multivariable models, we considered variables previously found to be associated with HIV sexual risk behaviors [28], including age, city, internalized homophobia, intimate partner violence, and variables associated ( $p < 0.10$ ) with disclosure of HIV status in the bivariable chi-square analysis. We retained HIV viral load in the multivariable model because of prior findings indicating that beliefs of receiving ART or having undetectable viral load protect against transmitting HIV [31]. We conducted all analyses with SAS version 9.4 (SAS Institute, Inc., Cary, NC).

## Results

### Sample Characteristics

We included 143 HIV-positive Black MSM in this analysis, the majority of which were 35 years of age or older (85%), earned less than \$20,000 in annual household income (66%), and reported only having sex with men (80%). Sixty-four percent of the men reported ART use

in the past month, and 53% were virally suppressed. Forty-three percent and 42% of the men reported condomless insertive and receptive anal intercourse respectively with their last male partner; whereas, 17% and 18% of the sample engaged in condomless insertive and condomless receptive anal intercourse with a serodiscordant/unknown status partner respectively. Documenting a group that could potentially transmit HIV, 20% and 15% of the sample reported condomless insertive and condomless receptive anal intercourse with their last male partner and not being virally suppressed.

### Disclosure of HIV Status

Approximately 58% ( $n = 78$ ) reported disclosing their HIV status to their last male anal sex partner (Table 1). In bivariable analysis (Table 1), the proportion of men who disclosed their HIV status was significantly greater in those who reported attending religious/spiritual services compared with those who did not (63% vs. 38%;  $p = 0.01$ ). In addition, a significantly greater proportion of the men disclosed their HIV status if their last male anal sex partner was their primary partner compared with other types of partnership (71% vs. 53%;  $p = 0.04$ ). Additionally, the proportion of men disclosing their HIV status was significantly greater in those who did not engage in condomless insertive intercourse with a serodiscordant/unknown status partner compared with those who did not (64% vs. 26%;  $p \leq 0.01$ ). However, there was no statistically significant difference in HIV disclosure by condomless receptive intercourse with a serodiscordant/unknown status partner (CRAI-SUP 61% vs. 47%;  $p = 0.16$ ). HIV status disclosure did not differ significantly in participants with suppressed vs. unsuppressed viral loads (60% vs. 52%;  $p = 0.37$ ).

### Multivariable Regressions of Disclosure of HIV Status and Sexual Risk Behaviors

There was no significant association between HIV status disclosure and reporting condomless insertive anal intercourse (aOR = 0.35, 95% CI 0.11, 1.08;  $p = 0.30$ ; Table 2) or condomless receptive anal intercourse (aOR = 2.48, 95% CI 0.94, 6.52;  $p = 0.20$ ; Table 2). In the models associating disclosure of HIV status with serodiscordant/unknown status partner, disclosure of HIV status compared with nondisclosure was significantly associated with lower odds of reporting condomless insertive anal intercourse with a serodiscordant/unknown status partner (aOR =

0.19, 95% CI 0.06, 0.68;  $p \leq 0.01$ ). However, results for condomless receptive anal intercourse with a serodiscordant/unknown status partner was not statistically significant (aOR = 0.55, 95% CI 0.20, 1.49;  $p = 0.45$ ). We adjusted all models for the same set of covariates, including age, partner type, religious/spiritual service attendance, sexual behavior, and viral load suppression. All other variables, including depression symptoms and alcohol and substance use, were not statistically significantly associated with any of the HIV sexual risk behavior outcomes. In an exploratory analysis, we created discrete categories of HIV status disclosure based on viral load suppression status. Suppressed disclosers had significantly lower predicted condomless insertive anal intercourse compared with non-suppressed nondisclosers (20% vs. 51%;  $p = 0.04$ ; Fig. 1). Contrastingly, for the condomless receptive anal intercourse outcome, suppressed disclosers had significantly higher predicted CRAI compared with non-suppressed nondisclosers (61% vs. 26%;  $p = 0.02$ ; Fig. 1). We did not test comparisons for condomless insertive anal intercourse and condomless receptive anal intercourse with a serodiscordant/unknown status partner because the numbers for some cells were too small.

### Discussion

Over half (58%) of the HIV-positive Black MSM recruited in six cities in the USA reported disclosing their HIV status with their last anal sex partner before engaging in anal sex. Disclosure of HIV status was also significantly associated with reduced odds of engaging in condomless insertive anal intercourse with a serodiscordant/unknown status partner. Furthermore, a substantial percentage of the men engaged in high transmitting behaviors, including condomless insertive (20%) and receptive (15%) anal intercourse, while having unsuppressed HIV viral loads.

Consistent with other research, our analysis indicates that the prevalence of HIV status disclosure to sexual partners remains high among MSM. Prior studies among MSM in the USA indicate rates of HIV status nondisclosure to range between 43 and 70% [16, 32–34], with one recent study among HIV-positive men living with HIV and receiving care in Florida finding 88% of MSM reporting disclosure of their HIV status to some or all of their sexual partners [35]. Still, there remains a substantial proportion of MSM who do not disclose their HIV status to

**Table 1** Baseline characteristics of Black men who have sex with men in the HPTN 061 study stratified by HIV status disclosure to last sexual partner (*N* = 143)

Variables	HIV Disclosure						<i>p</i> value
	Overall <sup>1</sup>		Yes		No		
	<i>N</i>	Row %	<i>n</i>	Row %	<i>n</i>	Row %	
	135	100	78	57.8	57	42.2	
Age (years)							
18–24	6	4.2	2	33.3	4	66.7	0.34
25–34	16	11.2	8	50.0	8	50.0	
= > 35	121	84.6	68	60.2	45	39.8	
City							
Atlanta	21	14.7	9	47.4	10	52.6	0.34
New York	25	17.5	17	68.0	8	32.0	
Washington DC	15	10.5	10	66.7	5	33.3	
Boston	23	16.1	9	42.9	12	57.1	
Los Angeles	46	32.2	28	63.6	16	36.4	
San Francisco	13	9.1	5	45.5	6	54.5	
Education							
High school or less	72	50.3	39	60.0	26	40.0	0.61
College or more	71	49.7	39	55.7	31	44.3	
Annual household income							
< \$20,000	93	66.0	50	58.1	36	41.9	0.86
\$20,000–\$49,000	38	27.0	22	59.5	15	40.5	
= > \$50,000	10	7.1	5	50.0	5	50.0	
History of incarceration							0.23
No	48	34.0	24	51.1	23	48.9	
Yes	93	66.0	53	61.6	33	38.4	
How often attend religious/spiritual services							
Never	31	22.0	11	37.9	18	62.1	0.01
Yes	110	78.0	66	63.5	38	36.5	
Partner status							
Primary	41	30.8	29	70.7	12	29.3	0.05
Other†	92	69.2	48	52.7	43	47.3	
HIV status of last partner							
Positive	61	44.9	53	86.9	8	13.1	<.01
Negative/unknown	75	55.1	25	33.8	49	66.2	
Sexual behavior							
MSMO	115	80.4	60	55.0	49	45.0	0.18
MSMW	28	19.6	18	69.2	8	30.8	
Intimate partner violence							
No	60	42.6	33	60.0	22	40.0	0.62
Yes	81	57.4	44	55.7	35	44.3	
HIV treatment optimism							
No	120	86.3	68	59.1	47	40.9	0.49
Yes	19	13.7	8	47.1	9	52.9	
Internalized homophobia							
Low	101	70.6	58	59.8	39	40.2	0.72
Medium	33	23.1	16	53.3	14	46.7	
High	9	6.3	4	50.0	4	50.0	

**Table 1** (continued)

Variables	HIV Disclosure						<i>p</i> value
	Overall <sup>1</sup>		Yes		No		
	<i>N</i>	Row %	<i>n</i>	Row %	<i>n</i>	Row %	
	135	100	78	57.8	57	42.2	
Significant depression symptoms							
No	66	47.1	39	61.9	24	38.1	0.33
Yes	74	52.9	37	53.6	32	46.4	
Buzzed/drank on alcohol last time had anal sex							
No	54	40.0	33	61.1	21	38.9	0.57
Yes	81	60.0	45	56.3	35	43.8	
Any substance use within 2 h before/during CAI							
No	53	37.6	30	60.0	20	40.0	0.60
Yes	88	62.4	46	55.4	37	44.6	
Condomless insertive anal intercourse (CIAI)							
No	77	57.5	43	56.6	33	43.4	0.72
Yes	57	42.5	34	59.6	23	40.4	
Condomless receptive anal intercourse (CRAI)							
No	79	58.5	41	51.9	38	48.1	0.10
Yes	56	41.5	37	66.1	19	33.9	
CIAI with negative/unknown status partner							
No	113	83.1	72	64.3	40	35.7	<.01
Yes	23	16.9	6	26.1	17	73.9	
CRAI with negative/unknown status partner							
No	106	77.9	64	61.0	41	39.0	0.16
Yes	30	22.1	14	46.7	16	53.3	
ART use (last month)							
No	48	36.4	27	58.7	19	41.3	0.91
Yes	84	63.6	45	57.7	33	42.3	
Viral load suppression							
No	61	46.6	29	51.8	27	48.2	0.37
Yes	70	53.4	40	59.7	27	40.3	
Unsuppressed CIAI							
No	98	80.3	56	57.7	41	42.3	0.49
Yes	24	19.7	12	50.0	12	50.0	
Unsuppressed CRAI							
No	105	85.4	57	54.3	48	45.7	0.32
Yes	18	14.6	12	66.7	6	33.3	
Unsuppressed CIAI-with negative/unknown status partner							
No	114	91.9	67	59.3	46	40.7	0.01
Yes	10	8.1	2	20.0	8	80.0	
Unsuppressed CRAI-with negative/unknown status partner							
No	115	92.7	65	57.0	49	43.0	0.46
Yes	9	7.3	4	44.4	5	55.6	

<sup>1</sup>Based on data from 135 HIV-positive men in the sample with non-missing data on HIV status disclosure

†Other includes steady, casual exchange/trade, or anonymous partner

**Table 2** Associations between HIV status disclosure and sexual risk behavior among BMSM

Variable	Condomless insertive anal intercourse (CIAI)		Condomless receptive anal intercourse (CRAI)	
	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
HIV status disclosure				
No	Ref.	Ref.	Ref.	Ref.
Yes	1.13 (0.57, 2.28)	0.35 (0.11, 1.08)	1.80 (0.89, 3.66)	2.48 (0.94, 6.52)
Age (in years)	1.00 (0.97, 1.04)†	0.99 (0.95, 1.04)	1.02 (0.98, 1.06)†	1.01 (0.96, 1.05)
Partner type				
Primary	Ref.	Ref.	Ref.	Ref.
Other	1.97 (0.89, 4.37)	2.47 (0.95, 6.45)	0.72 (0.38, 1.52)	0.65 (0.27, 1.53)
HIV status of last partner				
Positive	Ref.	Ref.	Ref.	Ref.
Negative/unknown	0.37 (0.18, 0.74)***	0.16 (0.05, 0.50)***	0.92 (0.46, 1.83)	1.58 (0.61, 4.05)
Attend religious/spiritual services				
No	Ref.	Ref.	Ref.	Ref.
Yes	1.39 (0.60, 3.22)	2.09 (0.68, 6.43)	0.87 (0.38, 1.99)	0.82 (0.29, 2.28)
Sexual behavior				
MSMO	Ref.	Ref.	Ref.	Ref.
MSMW	1.20 (0.51, 2.84)	1.00 (0.33, 3.01)	1.27 (0.54, 2.99)	1.53 (0.54, 4.34)
Viral load suppression				
Yes	Ref.	Ref.	Ref.	Ref.
No	1.15 (0.56, 2.38)	1.44 (0.62, 3.36)	0.55 (0.26, 1.15)	0.58 (0.26, 1.31)

\* $p < 0.05$ \*\* $p < 0.01$ \*\*\* $p < 0.001$ † $p < 0.10$ 

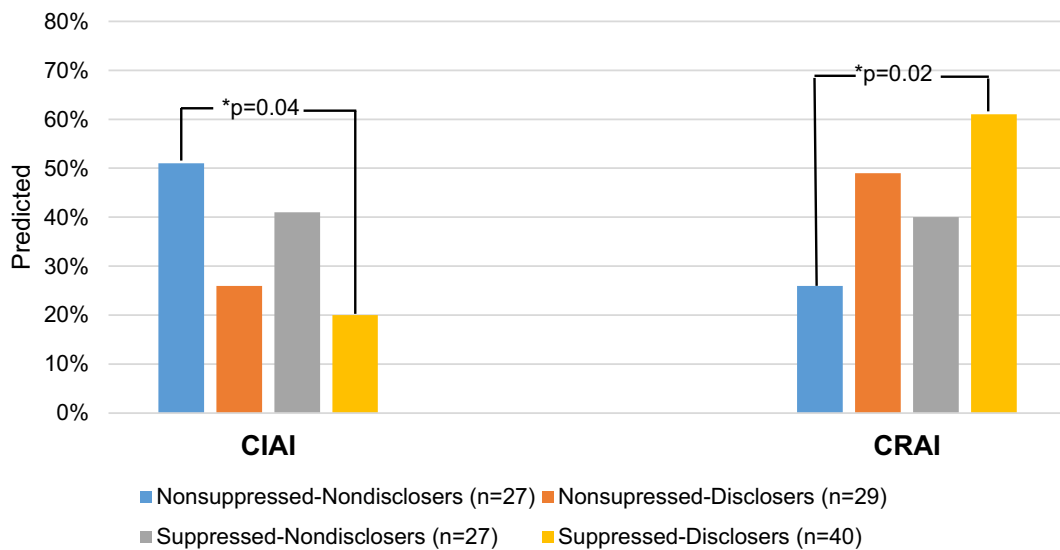
OR, odds ratio; aOR, adjusted odds ratio; Ref, reference

sexual partners. In the present study, at least 42% of Black MSM did not disclose their HIV status to their last anal sex partner. One potential explanation for nondisclosure of HIV status to sexual partners could be HIV stigma. Negative attitudes and beliefs about being HIV positive may reduce the likelihood of an individual disclosing their HIV status [36, 37]. Indeed, greater internalized stigma has been associated with less HIV status disclosure to sexual partners among HIV-positive Black MSM [38]. The negative effects of HIV-related stigma are compounded among Black MSM because they experience multiple stigmatized identities from their sexual orientation and HIV status [38, 39]. As such, interventions that serve to reduce HIV-related stigma among Black MSM may have a bearing on sexual

risk reduction approaches such as HIV status disclosure to sexual partners.

Furthermore, it is interesting that this analysis found that a greater proportion of Black MSM are attending religious/spiritual services compared with those who did not disclose their HIV status to their last anal sex partner. Involvement in religious/spiritual services and practices has been associated with reduced sexual risk behaviors [40, 41]. The increased social support, coping resources, and positive feelings are some factors proposed to mediate the associations between religious/spiritual involvement and positive health behaviors and outcomes [42]. While few studies have specifically assessed the role of religious and spiritual involvement on HIV status disclosure among Black MSM, our preliminary finding of a greater proportion of HIV status disclosure among Black





**Fig. 1** HIV sexual risk behaviors by disclosure and viral suppression status among BMSM in HPTN061. Results are predicted values from multivariable logistic models that adjusted for age, partner type, attendance at religious/spiritual services, and sexual behavior

MSM attending religious/spiritual services warrants further investigation.

HIV status nondisclosure to sexual partners could increase the risk of HIV transmission, making HIV disclosure an important HIV transmission risk reduction strategy [10]. Furthermore, our study found that a minority of Black MSM (8%) engaged in high HIV transmitting behaviors (i.e., receptive and insertive condomless anal intercourse with a serodiscordant/unknown status partner while unsuppressed). Considering these findings, additional studies focused on systematically assessing factors associated with engaging in high HIV transmission behaviors in the context of HIV status disclosure to sex partners is clearly warranted.

Importantly, racial disparities have been reported in HIV status disclosure. In some samples, Black MSM had lower rates of HIV status disclosure to sex partners compared with their White counterparts [13, 20, 21]. This has important implications for the racial disparities in HIV incidence in the USA, which is disproportionately higher in Black MSM than White MSM [1]. HIV status disclosure is a complex process that can depend on a variety of factors including characteristics of the sex partner (such as partnership type, age, and race/ethnicity of the partner), whether participants reside in a state that criminalizes HIV status nondisclosure, sexual venue, violence, abuse, HIV-related stigma, and fear of rejection [11, 43]. Although some disclosure intervention studies have demonstrated efficacy in increasing

disclosure to sexual partners [44], additional investigations on facilitators and barriers of disclosure of HIV status to sex partners not addressed here can help in the design of more rigorous intervention studies, particularly among Black MSM.

In this analysis, viral suppression was not significantly associated with either disclosure of HIV status or engaging in any of the HIV sexually transmission behaviors examined in this study. Some studies suggest that persons living with HIV who are receiving ART and are virally suppressed may be less likely to disclose their HIV serostatus possibly because of beliefs that they are not likely to transmit HIV to their sexual partners [35]. The participants in our study were recruited between 2009 and 2010, prior to the publication of results from the HPTN 052 study that demonstrated treatment as prevention [45]. Therefore, the lack of association between viral load suppression and HIV status disclosure in our study may be because of a lack of awareness of treatment as prevention among our study participants. Recently, Kalichman et al. (2016) found that HIV positive men residing in Atlanta with undetectable viral loads reported higher HIV status disclosure to their sexual partners when compared with the men with detectable HIV viral load. Knowledge of “undetectable equals untransmittable,” or “U = U” [46] and the increasing use of PrEP may reduce the need for HIV status disclosure among some MSM. However, status disclosure may still have an important role in the negotiation

**Table 3** Associations between HIV status disclosure and sexual risk behavior among BMSM

Variable	Condomless insertive anal intercourse with negative/ unknown status partner		Condomless receptive anal intercourse with negative/ unknown status partner	
	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
HIV status disclosure				
No	Ref.	Ref.	Ref.	Ref.
Yes	0.20 (0.07, 0.54)***	0.19 (0.06, 0.68)***	0.56 (0.25, 1.27)	0.55 (0.20, 1.49)
Age (in years)	0.96 (0.92, 1.01)†	0.97 (0.91, 1.03)†	0.99 (0.95, 1.04)	0.97 (0.92, 1.02)†
Partner type				
Primary	Ref.	Ref.	Ref.	Ref.
Other	3.30 (0.92, 11.86)	3.46 (0.70, 17.16)	0.75 (0.11, 1.82)	0.53 (0.19, 1.49)
Attend religious/spiritual services				
No	Ref.	Ref.	Ref.	Ref.
Yes	0.78 (0.28, 2.20)	1.23 (0.34, 4.42)	0.59 (0.24, 1.48)	0.54 (0.18, 1.64)
Sexual behavior				
MSMO	Ref.	Ref.	Ref.	Ref.
MSMW	0.34 (0.07, 1.53)	0.79 (0.15, 4.18)	1.31 (0.49, 3.47)	2.45 (0.75, 8.04)
Viral load suppression				
Yes	Ref.	Ref.	Ref.	Ref.
No	1.21 (0.47, 3.16)	1.17 (0.39, 3.54)	0.51 (0.21, 1.25)	0.42 (0.15, 1.15)

\* $p < 0.05$ \*\* $p < 0.01$ \*\*\* $p < 0.001$ † $p < 0.10$ 

OR, odds ratio; aOR, adjusted odds ratio; Ref, reference

of HIV-preventive behaviors among Black MSM, who have higher HIV incidence rates, lower rates of PrEP uptake, and lower rates of sustained viral suppression compared with men from other race/ethnicity backgrounds [47, 48].

In this analysis, we found no significant association between HIV status disclosure and condomless insertive or receptive intercourse, overall. However, HIV status disclosure was significantly associated with reduced odds of engaging in condomless insertive intercourse with a serodiscordant/unknown status partner. However, the literature is not consistent with this finding. For instance, Serovich et al. found no significant association between HIV status disclosure and penetrative sex with HIV-negative/unknown status partners among a racial/ethnic diverse MSM [17]. In another study of predominantly young Black MSM, Cook et al. found no significant association between HIV status disclosure to sex partners and unprotected anal sex with a serodiscordant partner

[18]. The reason for the difference between our findings and these two studies are likely related to differences in the study sample and the covariates we included in the models. In our study, we found no significant association between HIV status disclosure and condomless insertive anal intercourse and condomless receptive anal intercourse. In contrast, HIV status disclosure was significantly associated with reduced odds of condomless insertive anal intercourse with a serodiscordant/unknown status partner. This would be consistent with a process of serosorting [10] where men disclose their HIV statuses when the potential for transmission is non-negligible. Also consistent with this process, men with viral suppression who disclosed serostatus were significantly more likely to engage in condomless receptive anal intercourse with a serodiscordant/unknown status partner compared with men who were non-suppressed and non-disclosure. These findings are also consistent with findings showing that for some MSM who engage in

receptive sex, the responsibility of condom use in a sexual situation belongs to the insertive partner [49, 50].

Our study findings should be interpreted within the scope of some limitations. The primary variables used in our study, particularly disclosure of HIV status, partner HIV status, and HIV sexual risk behaviors, were assessed via self-report topics that may be prone to social desirability biases. Conceivably, HIV status disclosure to sexual partners and condom use during anal intercourse may have been over-reported. Another limitation is that we did not have data on HIV status disclosure at the time anal intercourse occurred. Therefore, we were only able to test associations between HIV status disclosure and sexual behaviors on a global level (Tables 2 and 3). In addition, the counts for HIV status disclosure in some cells for the outcomes we assessed were small, reducing the power to detect significant differences in some of our findings. Finally, we did not include other covariates potentially associated with HIV status disclosure and HIV sexual risk behaviors, such as the number of anal sex partners.

## Conclusion

Among this multi-city sample of HIV-positive Black MSM, disclosure of HIV status was common and associated with lower HIV sexual risk behaviors. Still, up to a third of the sample did not disclose their HIV status to their partners, and nearly a quarter engaged in undisclosed condomless anal intercourse with a serodiscordant/unknown status partner, representing high HIV transmission risk behaviors. These findings indicate that there remains a need to develop prevention messages that reach a small but important group of MSM living with HIV and who report CAI with a serodiscordant/unknown status partner. Qualitative research would be useful in better elucidating the facilitators and barriers to HIV status disclosure to sex partners among Black MSM. HIV case managers and medical care providers have an important role in increasing awareness of and educating Black MSM on the importance of HIV status disclosure as well as delivering risk reduction interventions. In addition, internet-delivered interventions and mobile phone-based applications may be advantageous in reaching and engaging hard-to-reach groups. In this era of highly active biomedical HIV prevention strategies, culturally competent,

feasible, and effective combination prevention interventions for this group of MSM living with HIV seem achievable and sustainable and should be a key part of comprehensive interventions to stop HIV transmission. Finally, community-based organizations that implement prevention/treatment interventions need to consider and address implementation barriers, including staff training and retention, agency resources (including space), and the impact of adopting and modifying evidence-based interventions to fit their clientele without loss of effectiveness [51, 52].

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## Compliance with Ethical Standards

The Institutional Review Boards at all sites approved the study.

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