

## Original Investigation

# Sexual Risk Behavior Among Virologically Detectable Human Immunodeficiency Virus–Infected Young Men Who Have Sex With Men

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**IMPORTANCE** Human immunodeficiency virus (HIV) diagnoses continue to increase among young men who have sex with men (YMSM). Many YMSM living with HIV engage in sexual risk behaviors, and those who have a detectable viral load can transmit HIV to sex partners. Understanding factors that are related to sexual risk taking among virologically detectable (VL+) YMSM can inform prevention and treatment efforts.

**OBJECTIVES** To describe differences between virologically suppressed (VL–) and VL+ YMSM living with HIV and to identify correlates of condomless anal intercourse (CAI) and serodiscordant CAI among VL+ YMSM.

**DESIGN, SETTING, AND PARTICIPANTS** In this cross-sectional survey conducted from December 1, 2009, through June 30, 2012, we studied 991 HIV-infected YMSM 15 to 26 years of age at 20 adolescent HIV clinics in the United States. Data analysis was conducted December 1, 2013, through July 31, 2015.

**MAIN OUTCOMES AND MEASURES** Demographic, behavioral, and psychosocial assessments obtained using audio computer-assisted self-interviews. Viral load information was obtained via blood draw or medical record abstraction.

**RESULTS** Of the 991 participants, 688 (69.4%) were VL+ and 458 (46.2%) reported CAI, with 310 (31.3%) reporting serodiscordant CAI in the past 3 months. The VL+ YMSM were more likely than the VL– YMSM to report CAI (detectable, 266 [54.7%]; suppressed, 91 [44.4%];  $P = .01$ ) and serodiscordant CAI (detectable, 187 [34.9%]; suppressed, 57 [25.0%];  $P < .01$ ). Multivariable analyses indicated that among VL+ YMSM, those reporting problematic substance use were more likely to report CAI (adjusted odds ratio [AOR], 1.46; 95% CI, 1.02–2.10) and serodiscordant CAI (AOR, 1.45; 95% CI, 1.06–1.99). Black VL+ YMSM were less likely to report CAI (AOR, 0.63; 95% CI, 0.44–0.90) or serodiscordant CAI (AOR, 0.66; 95% CI, 0.46–0.94) compared with other VL+ YMSM. In addition, VL+ YMSM who disclosed their HIV status to sex partners were more likely to report CAI compared with nondisclosing YMSM (AOR, 1.35; 95% CI, 1.01–1.81). Transgender participants were less likely to report CAI than cisgender participants (AOR, 0.35; 95% CI, 0.14–0.85). Last, VL+ YMSM who reported currently being employed were less likely to report serodiscordant CAI than those who were unemployed (AOR, 0.74; 95% CI, 0.55–0.99).

**CONCLUSIONS AND RELEVANCE** Targeted multilevel interventions are needed to reduce HIV transmission risk behaviors among YMSM living with HIV, particularly among those who are VL+.

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Human immunodeficiency virus (HIV) continues to disproportionately affect men who have sex with men (MSM) in the United States. The most recent seroprevalence data available from the US Centers for Disease Control and Prevention suggest that the HIV epidemic is increasing among MSM, whereas it is relatively stable in heterosexual populations.<sup>1,2</sup> Young MSM (YMSM) (13-29 years of age) are particularly vulnerable to HIV infection. More than one-quarter of new infections in the United States occur in YMSM,<sup>1</sup> and this population constitutes more than 70% of new HIV infections among youths.<sup>3</sup> Black YMSM and young transgender women are subgroups disproportionately affected by HIV. In 2009, black YMSM accounted for 61% of all new infections in the United States.<sup>1</sup> Likewise, HIV prevalence among transgender women in the United States has been estimated to be more than 20%.<sup>3</sup>

It is critical to implement biomedical and behavioral strategies to reduce the likelihood of transmission via male-to-male sexual contact, the primary mode through which HIV is transmitted among MSM.<sup>4</sup> In addition to condom use, chemoprophylaxis, and routine screening for HIV, treatment of HIV-infected individuals to improve their immune status and to suppress viral load drastically reduces the odds of transmission.<sup>5</sup> A landmark 6-year, global research study<sup>5</sup> found that early treatment and consistent adherence to antiretroviral treatment (ART) among HIV-infected individuals reduced transmission of HIV to uninfected sex partners by 96%. An ongoing observational trial of serodiscordant gay and heterosexual couples provides additional support for the efficacy of treating HIV-infected people to reduce onward transmission<sup>6</sup> and suggests that the paradigm of treatment as prevention has great potential as a strategy to reduce HIV among MSM.

The success of treatment as prevention in reducing the number of new infections among YMSM in the United States relies on increasing levels of HIV testing, ART uptake, adherence, and viral suppression among HIV-infected YMSM. However, challenges persist in keeping YMSM engaged in care and adherent to ART. For example, one review study<sup>7</sup> suggested that only 51% of HIV-infected youths achieve viral suppression. Among MSM, rates of suppression are even lower. A modeling study<sup>8</sup> found that only 34% of HIV-infected white MSM and 16% of HIV-infected black MSM achieve viral suppression. Other research has highlighted racial disparities in access to HIV care and uptake of treatment among HIV-infected MSM<sup>9</sup> and notably among YMSM.<sup>10</sup>

Those HIV-infected YMSM who are receiving care have perhaps the greatest chance among YMSM to be virally suppressed, although a recently conducted study<sup>11</sup> of HIV-infected youths and adolescents in care suggested that, among behaviorally infected youths, only 50% were currently receiving ART and only 27.1% were virally suppressed. Moreover, the study found that HIV-infected young men and gay- or bisexual-identified HIV-infected youths were less likely than HIV-infected young women and heterosexual HIV-infected youth, respectively, to be receiving ART.

Behavioral approaches to improve engagement in care and adherence to medication specifically may need to occur in tandem with interventions to reduce sexual risk behaviors, such

### At a Glance

- A total of 688 (69.4%) of the human immunodeficiency virus (HIV)-infected young men who have sex with men (YMSM) in the sample had a detectable viral load.
- The HIV-infected YMSM with a detectable viral load were more likely to report sexual risk behavior compared with those who were virally suppressed. More than half (266 [54.7%]) of detectable YMSM reported condomless anal intercourse (CAI), whereas 91 (44.4%) of those who were suppressed reported CAI ( $P = .01$ ). Likewise, 187 (34.9%) of the detectable YMSM reported CAI with an HIV-negative partner, whereas only 57 (25.0%) of suppressed YMSM reported serodiscordant CAI ( $P < .01$ ).
- Factors related to CAI among virally detectable YMSM included problematic substance use, nonblack race, disclosure of HIV to sex partners, cisgender identity, and current unemployment.

as condomless anal intercourse (CAI). Numerous studies<sup>12-15</sup> have found that many HIV-infected YMSM engage in risky sexual behaviors after their diagnosis. Young MSM who are not virally suppressed may be at particular risk to engage in sexual risk behaviors that serve to perpetuate HIV transmission.

Demographic factors, such as age, sex, race/ethnicity, and socioeconomic factors, and psychosocial factors, such as disclosure to sex partners, substance use, and poor mental health, are related to enhanced sexual risk among MSM.<sup>9,16-18</sup> However, few studies have explored these factors specifically among HIV-infected YMSM who are virologically detectable.

The current study has 2 aims: (1) to describe differences in demographic and psychosocial factors between virologically suppressed (VL-) and virologically detectable (VL+) HIV-infected YMSM who are currently in care and (2) to identify psychosocial factors associated with any CAI and serodiscordant CAI in the past 3 months among VL+ HIV-infected YMSM.

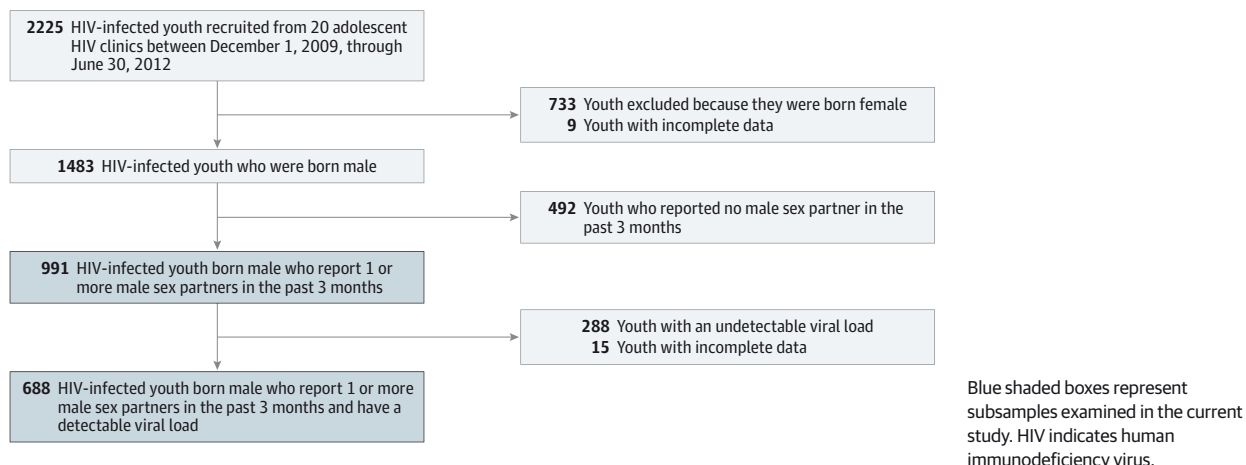
## Methods

### Sample

From December 1, 2009, through June 30, 2012, a total of 2225 HIV-infected youths linked to care at clinics associated with the Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN) were recruited to participate in a cross-sectional survey. The 20 clinics were located in major US cities and Puerto Rico (see Acknowledgments section for specific locations of clinics). Data analysis was conducted December 1, 2013, through July 31, 2015.

To be eligible, youths had to be (1) 12 through 26 years of age, (2) living with HIV/AIDS, (3) aware they were HIV infected, (4) linked to care in one of the ATN's clinical sites or affiliates (eg, had at least one clinic visit during the enrollment period), and (5) able to understand English or Spanish. The study was approved by the institutional review boards at all participating sites and those from the members of the protocol team. The current study focuses on a subsample of participants whose birth sex was male (regardless of their current gender identity) and who reported sexual behavior (ie, oral or anal intercourse) with another male in the 3 months before

Figure. Participant Flow Diagram



the survey (991 [44.5%] of the total sample). The **Figure** shows the flow of the participants throughout the study.

Research staff approached all youth who met eligibility criteria during one of their scheduled clinic visits. After a thorough explanation of the study, staff obtained signed written informed consent or assent from youths agreeing to participate. Within 2 weeks of providing consent or assent, participants completed audio computer-assisted self-interviews to assess psychosocial and health factors, which took approximately 45 to 90 minutes. Health-related data, including most recent viral load, were also abstracted from participants' medical records. In a few cases in which recent (within the 6 months before study enrollment) viral load data were not available, blood samples were taken for measurement. Participants were given a small incentive determined by the sites' institutional review boards as compensation for their time.

### Measures

The assessment measured 3 primary constructs: (1) substance use, (2) mental health, and (3) sexual behavior. The assessment also obtained demographic information, including age, birth sex, current gender identity, race/ethnicity, sexual orientation, route of HIV infection, housing status, incarceration history, and disclosure of HIV status to sexual partners. Health-related data abstracted from medical records included whether the participant was prescribed ART (dichotomous variable), the date ART was prescribed (dichotomized into 2 groups:  $\leq 6$  and  $> 6$  months since starting ART), the date of confirmatory HIV diagnosis (dichotomized into 2 groups:  $\leq 6$  and  $> 6$  months since diagnosis), and most recent viral load. Specific information on the measures and viral load assessments used follows.

### Substance Use

The Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST)<sup>19</sup> was used to measure substance use behaviors, and the Car, Relax, Alone, Forget, Friends, Trouble (CRAFFT)<sup>20</sup> was used to assess problematic substance use. Eight items on the ASSIST questionnaire were used to assess

the frequency and consequences of substance use. The current study examined daily use of alcohol and marijuana because these were the main substances study participants reported using. CRAFFT is a 6-item measure designed to assess the consequences of alcohol and/or marijuana use by adolescents and young adults in clinical settings. Scores of 2 or higher are suggestive of problem substance use, abuse, and/or dependence.

### Mental Health

Mental health issues were assessed with the Brief Symptom Inventory (BSI),<sup>21</sup> which yields 9 primary symptom scales, and a Global Severity Index (GSI), which has norms based on age (ie, adolescent and adult) and sex. The GSI reflects an overall evaluation of a respondent's psychopathological status. The BSI depression and anxiety subscales and the GSI were used in the current analyses.

### Sexual Behavior

A 38-item questionnaire was used to assess sexual behaviors during the past 90 days. Participants reported the number of male and female sex partners and the frequency of condomless oral, vaginal, and anal sexual activity with HIV-infected, HIV-negative, and unknown-status male and female partners.

### Viral Load

Plasma HIV RNA and CD4<sup>+</sup> cell count data obtained within the last 6 months and type of assay were abstracted from medical records. Because of the variability in type of assay used across the study sites (ie, Versant HIV-1 RNA 3.0 [Siemens Diagnostics]; Amplicor HIV-1 Monitor - Standard/ ultrasensitive [F. Hoffmann-La Roche Ltd]; COBAS AmpliPrep/COBAS Taqman HIV-1 Test, versions 1.0 and 2.0 [F. Hoffmann-La Roche Ltd]; and RealTime HIV-1 Assay [Abbott Laboratories]), we used the corresponding assay cutoff for the lower limit of HIV RNA detection (all were  $< 200$  copies/mL; see Kahana et al<sup>11</sup> for sensitivity analysis) and created a dichotomous variable to differentiate VL- and VL+ participants.

**Table 1. Variable Frequencies for Full Sample and Comparison Between VL- and VL+ Subsamples of 991 HIV-Infected YMSM<sup>a</sup>**

Variable	Full Sample (N = 991)	VL- Subsample (n = 233)	VL+ Subsample (n = 549)	P Value
Age ≥21 y	352 (35.5)	61 (26.2)	216 (39.5)	<.01
Current employment	437 (44.1)	121 (52.2)	217 (39.6)	<.01
Post-high school educational level	410 (41.4)	124 (53.4)	190 (34.7)	<.01
Transgender	54 (5.4)	8 (3.4)	33 (6.0)	.14
Black race	628 (63.4)	144 (62.3)	348 (63.5)	.76
Hispanic ethnicity	219 (22.1)	56 (24.0)	126 (23.1)	.77
Ever incarcerated	358 (36.1)	72 (30.9)	215 (39.2)	.03
Current unstable housing	54 (5.4)	9 (3.9)	32 (6.0)	.25
Prescribed ART	516 (52.1)	225 (96.6)	89 (16.2)	<.01
Receiving ART for ≤6 months	175 (17.7)			
Disclosure to sex partners	464 (46.8)	108 (50.9)	246 (50.5)	.92
CRAFFT, mean (SD)	2.7 (1.8)	2.7 (1.8)	2.7 (1.8)	.79
Daily alcohol use	59 (6.0)	9 (4.1)	37 (7.3)	.10
Daily marijuana use	265 (26.7)	55 (31.8)	155 (36.4)	.29
BSI depression subscale score, mean (SD)	7.0 (6.1)	6.3 (5.7)	7.3 (6.2)	.03
BSI anxiety subscale score, mean (SD)	5.4 (5.4)	4.7 (5.1)	5.7 (5.4)	.02
BSI GSI score, mean (SD) <sup>b</sup>	1.0 (0.8)	0.9 (0.8)	1.1 (0.8)	.03
CAI	458 (46.2)	91 (44.4)	266 (54.7)	.01
Serodiscordant CAI	310 (31.3)	57 (25.0)	187 (34.9)	.01

Abbreviations: ART, antiretroviral treatment; BSI, Brief Symptom Inventory; CAI, condomless anal intercourse; CRAFFT, Car, Relax, Alone, Forget, Friends, Trouble (keywords in a screening questionnaire to identify at-risk teen substance abusers); GSI, Global Severity Index; HIV, human immunodeficiency virus; VL-, virologically suppressed; VL+, virologically detectable; YMSM, young men who have sex with men.

<sup>a</sup> Data are presented as number (percentage) unless otherwise indicated.

<sup>b</sup> The BSI GSI criteria for clinically indicative symptoms are as follows: males 19 years or younger with GSI scores of 1.71 or higher, females 19 years or younger with GSI scores of 1.59 or higher, males 20 years or older with GSI scores of 0.58 or higher, and females 20 years or older with GSI scores of 0.78 or higher.

### Statistical Analysis

Demographic, health-related (except for BSI subscales), and substance use variables were primarily nominal or ordinal and were transformed to dichotomous variables for analytical purposes. These variables were compared between VL- and VL+ participants using standard descriptive statistics. Given the time needed to achieve viral suppression after starting ART, YMSM who had been receiving ART for 6 months or less (175 [17.7%] of the sample) were excluded from the analyses comparing VL+ and VL- YMSM.

Logistic regression analyses were conducted to explore factors related to any CAI and serodiscordant CAI among the subsample of VL+ YMSM. We used generalized estimating equations with robust SE estimates to account for the correlation due to clustering of participants within clinics. Analyses occurred in 2 steps. Variables were examined in univariable logistic regression models to test associations between each independent variable and the 2 CAI outcome variables. Factors that were observed to be statistically significant ( $P \leq .10$ ) in univariable models were included in separate generalized estimating equation models predicting the 2 CAI outcome variables. Because of multicollinearity, the BSI depression and anxiety and GSI variables were each examined in separate multivariable models with other variables observed to be significant in the univariable analyses. Estimates for non-BSI variables included in the multivariable models did not differ among models with different BSI subscale variables; thus, estimates for non-BSI variables are presented from multivariable models that included the GSI variable. All analyses were conducted using SPSS statistical software, version 22.0 (SPSS Inc).

### Results

Frequencies for variables included in the analyses are presented in Table 1. Just more than half (52.1%) of YMSM reported currently being prescribed ART. Nearly half (46.2%) of YMSM reported CAI in the past 3 months, whereas 310 (31.3%) reported serodiscordant CAI.

#### Demographic and Psychosocial Differences Between VL- and VL+ HIV-Infected YMSM

In total, 288 YMSM (29.1%) were VL-, whereas 688 (69.4%) were VL+; data were not available for 15 participants (1.5%). Excluding YMSM who were receiving ART for 6 months or less, 233 (29.3%) were VL- and 549 (69.0%) were VL+. Table 1 gives the differences between VL- and VL+ YMSM on study variables. Compared with YMSM who were VL-, those who were VL+ were more likely to be 21 years or older and to have ever been incarcerated. The VL+ YMSM were less likely to be currently employed and to report a post-high school educational level compared with VL- YMSM. In addition, VL+ YMSM had significantly higher scores than VL- YMSM on the BSI depression and anxiety subscales and the GSI. The VL+ YMSM were also more likely to report any CAI and serodiscordant CAI compared with VL- YMSM.

#### Factors Associated With CAI Among VL+ HIV-Infected YMSM

Univariable analyses revealed several factors associated with any CAI and serodiscordant CAI during the past 3 months among VL+ YMSM (eTable in the Supplement). Variables that

**Table 2. Multivariable Analysis Predicting Condomless Anal Intercourse in Past 3 Months Among 688 VL+ HIV-Infected YMSM**

Variable	Odds Ratio (95% CI)
Transgender	0.35 (0.14-0.85) <sup>a</sup>
Black race	0.35 (0.14-0.85) <sup>a</sup>
Disclosure to sex partners	0.63 (0.44-0.90) <sup>b</sup>
CRAFFT score $\geq 2$	1.35 (1.01-1.81) <sup>a</sup>
Daily alcohol use	1.46 (1.02-2.10) <sup>a</sup>
BSI depression subscale score <sup>c</sup>	1.86 (0.90-3.83)
BSI anxiety subscale score <sup>c</sup>	0.98 (0.96-1.01)
BSI GSI score <sup>c</sup>	0.98 (0.95-1.02)

Abbreviations: BSI, Brief Symptom Inventory; CRAFFT, Car, Relax, Alone, Forget, Friends, Trouble (keywords in a screening questionnaire to identify at-risk teen substance abusers); GSI, Global Severity Index; HIV, human immunodeficiency virus; VL+, virologically detectable; YMSM, young men who have sex with men.

<sup>a</sup>  $P \leq .05$ .

<sup>b</sup>  $P \leq .01$ .

<sup>c</sup> The BSI depression and anxiety and GSI variables were tested in separate multivariate models because of multicollinearity.

were negatively related to CAI included transgender gender identity and black or African American race, whereas those that were positively associated with CAI included disclosure of HIV status to sex partners, problematic substance use, daily alcohol use, and BSI depression and anxiety subscale and GSI scores. In addition, factors that were negatively associated with serodiscordant CAI included current employment and black or African American race, whereas those that were positively related to serodiscordant CAI included problematic substance use, daily alcohol use, and BSI depression and anxiety subscale and GSI scores.

Table 2 and Table 3 contain findings from the multivariable analyses. Transgender gender identity (adjusted odds ratio [AOR], 0.35; 95% CI, 0.14-0.85) and black or African American race (AOR, 0.64; 95% CI, 0.48-0.86) were negatively associated with CAI. Disclosure of HIV status to sex partners (AOR, 1.45; 95% CI, 1.08-1.94) and problematic substance use (AOR, 1.14; 95% CI, 1.04-1.25) were positively associated with CAI. Variables observed to be negatively associated with serodiscordant CAI were current employment (AOR, 0.74; 95% CI, 0.55-0.99) and black or African American race (AOR, 0.63; 95% CI, 0.47-0.84). Problematic substance use was positively associated with serodiscordant CAI (AOR, 1.10; 95% CI, 1.01-1.20).

## Discussion

This study is among the first to examine factors associated with sexual risk behaviors among VL+ YMSM. Condomless anal intercourse occurred with a relatively high level of frequency among YMSM in our sample. Furthermore, VL+ YMSM were more likely to report sexual risk behaviors than VL- YMSM. Taken together, findings suggest that to achieve the full promise offered by treatment as prevention for YMSM living with HIV, it is critical to develop behavioral interventions to address sexual risk behavior.<sup>2</sup>

**Table 3. Multivariable Analysis Predicting Serodiscordant Condomless Anal Intercourse in Past 3 Months Among 688 VL+ HIV-Infected YMSM**

Variable	Odds Ratio (95% CI)
Current employment	0.76 (0.58-0.99) <sup>a</sup>
Black race	0.66 (0.46-0.94) <sup>a</sup>
CRAFFT score $\geq 2$	1.45 (1.06-1.99) <sup>a</sup>
Daily alcohol use	1.52 (0.92-2.53)
BSI depression subscale score <sup>b</sup>	0.98 (0.95-1.00)
BSI anxiety subscale score <sup>b</sup>	0.99 (0.97-1.02)
BSI GSI score <sup>b</sup>	0.90 (0.74-1.09)

Abbreviations: BSI, Brief Symptom Inventory; CRAFFT, Car, Relax, Alone, Forget, Friends, Trouble (keywords in a screening questionnaire to identify at-risk teen substance abusers); GSI, Global Severity Index; HIV, human immunodeficiency virus; VL+, virologically detectable; YMSM, young men who have sex with men.

<sup>a</sup>  $P \leq .05$ .

<sup>b</sup> The BSI depression and anxiety and GSI variables were tested in separate multivariate models because of multicollinearity.

It was particularly troubling that in a sample of YMSM linked to care fewer than 3 in 10 (29.1%) were VL-. This estimate is on the lowest end of the range observed in observational studies included in a recently conducted review<sup>7</sup> of research examining the continuum of care for HIV-infected youth (ie, viral suppression rates ranged from 30% to 70%), suggesting stark disparities in viral suppression affecting HIV-infected YMSM.

Previous research<sup>22</sup> has found disparities in ART uptake and adherence affecting youth living with HIV. Demographic (ie, age, educational level) and structural (ie, unemployment, incarceration) factors were related to being VL+ among the YMSM in our sample. Likewise, mental health problems and engagement in sexual risk behaviors were associated with being VL+ among participants. Research has suggested that a confluence of structural, psychological, and behavioral factors enhance vulnerability to poor health outcomes among MSM, notably those who are YMSM and racial/ethnic minority MSM.<sup>18,23-25</sup>

Univariable analyses revealed that a number of demographic, psychological, behavioral, and structural factors were associated with CAI in the subsample of YMSM with a detectable viral load. However, multivariable analyses revealed the independent positive associations of problematic substance use, nonblack race, unemployment, cisgender identity, and HIV status disclosure to sexual risk behaviors (ie, any CAI and/or serodiscordant CAI) among VL+ YMSM. Previous research has found that substance use is associated with sexual risk behavior among YMSM<sup>26,27</sup> and also disrupts adherence and impedes uptake of ART.<sup>28,29</sup> Our findings suggest that substance use must continue to be a target of health promotion interventions targeting HIV-infected youth.

Findings from the study also illustrate the paradox described by Millet et al<sup>9</sup> in which black MSM have lower levels of sexual risk behaviors yet are the most highly affected by HIV in the United States. In our study, VL+ black YMSM had a lower likelihood of engaging in sexual risk behaviors compared with VL+ YMSM of other racial/ethnic groups. This finding underscores the role that social network and structural factors play in explaining enhanced HIV vulnerability among black YMSM.<sup>9</sup>

Our finding that transgender participants were less likely to report CAI compared with cisgender participants highlights the need for more research on the factors associated with high prevalence of HIV among transgender women. Similar to black YMSM, network-level factors, and not solely individual-level behaviors, may influence heightened risk for HIV in this population.<sup>3</sup>

The finding that YMSM who disclosed their HIV status to sex partners were more likely to report any CAI than those not disclosing their status is consistent with other research<sup>17</sup> and may suggest that many YMSM in the sample engaged in serosorting as a harm reduction strategy, given the significant association of disclosure to any CAI but not to serodiscordant CAI. Last, our findings suggest that socioeconomic factors, such as unemployment, are associated with increased HIV transmission risk behaviors. More research is needed to examine the mechanisms through which structural-level factors, such as joblessness, are related to sexual risk. For example, socioeconomic stress resulting from unemployment and related factors may lead to externalizing symptoms, such as sensation seeking and the use of sex to avoid or alleviate negative affect, which have been linked to sexual risk behavior among sexually active MSM.<sup>18,30,31</sup>

Our study is limited in that we used a cross-sectional approach that does not permit for causal inference. As noted, the

sample includes only HIV-infected YMSM who are linked to care and thus limits the generalizability of the findings. In addition, our sample included a small number of transgender participants. Future research is needed to explore the unique risk factors for poor health outcomes among HIV-infected transgender women. Despite these limitations, this research makes valuable contributions to our understanding of factors associated with viral detectability among HIV-infected YMSM and with sexual risk behavior among VL+ YMSM.

## Conclusions

Our findings highlight the inadequacies of treatment as prevention as the sole risk reduction method among HIV-infected YMSM in the United States and speak to a greater need for behavioral approaches to improve ART uptake and ultimately achieve higher rates of viral suppression in this population. Combination HIV prevention and treatment interventions, which include behavioral, biomedical, and structural strategies to increase viral suppression and reduce HIV transmission risk behaviors, that target HIV-infected YMSM are needed. To truly curb HIV incidence among YMSM, we cannot solely rely on one strategy to prevent and treat HIV.

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