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# HIV Disclosure and Transmission Risks to Sex Partners Among HIV-Positive Men

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## Abstract

Disclosure of HIV-positive status to sex partners is critical to protecting uninfected partners. In addition, people living with HIV often risk criminal prosecution when they do not inform sex partners of their HIV status. The current study examined factors associated with nondisclosure of HIV status by men living with HIV in Atlanta, GA (92% African African, mean age = 43.8), who engage in condomless sex with uninfected sex partners. Sexually active HIV-positive men ($N = 538$) completed daily electronic sexual behavior assessments over the course of 28 days and completed computerized interviews, drug testing, medication adherence assessments, and HIV viral load retrieved from medical records. Results showed that 166 (30%) men had engaged in condomless vaginal or anal intercourse with an HIV-uninfected or unknown HIV status sex partner to whom they had not disclosed their HIV status. Men who engaged in nondisclosed condomless sex were less adherent to their HIV treatment, more likely to have unsuppressed HIV, demonstrated poorer disclosure self-efficacy, enacted fewer risk reduction communication skills, and held more beliefs that people with HIV are less infectious when treated with antiretroviral therapy. We conclude that undisclosed HIV status is common and related to condomless sex with uninfected partners. Men who engage in nondisclosed condomless sex may also be more infectious given their nonadherence and viral load. Interventions are needed in HIV treatment as prevention contexts that attend to disclosure laws and enhance disclosure self-efficacy, improve risk reduction communication skills, and increase understanding of HIV infectiousness.

## Introduction

HIV prevention has shifted away from targeting behavior changes among individuals at-risk for HIV infection toward detecting those already infected and reducing their sexual infectiousness via antiretroviral therapy (ART).[1] Along with using ART for prevention, a strategy known as Treatment as Prevention, there is also emphasis on the need for people with HIV to inform their sex partners of their HIV status. Laws that criminalize failure to inform sex partners of one's HIV-positive status are becoming increasingly common.[2] For example, the CDC reports that a majority of US states have laws that require people with HIV to disclose their HIV status to sex partners and that all states have assault and reckless endangerment statutes that can and have been used to criminally prosecute people living with HIV for not disclosing their HIV status.[3] While HIV status disclosure laws are criticized and raise issues of social justice,[4] the question remains open as to whether HIV disclosure laws represent sound public health policy. Mathematical modeling shows that increases in HIV status disclosure to sex partners of infected individuals may reduce HIV transmission risks by as much as 40–60%.[5,6] Empirical studies confirm that individuals who disclose their HIV status are less likely to have multiple sex partners and more likely to use condoms with uninfected partners.[7] However, the factors that influence HIV status disclosure to sex partners are evolving, as HIV treatments are now used for HIV prevention and people may be informed that condoms are not necessary for preventing HIV transmission if they have undetected HIV in their blood plasma.[8]

In a diverse sample of men and women living with HIV, Przybyla et al.[9] found that 88% had disclosed their HIV status to their current partner and disclosure was inversely related to engaging in condomless intercourse. That is, greater disclosure of HIV status was associated with practicing safer sexual behaviors and this was true across subgroups of men who have sex with men, men who have sex with women, and women who have sex with men. In another recent study, Brown et al.[10] reported that among men who have sex with men, older men (age 50 and older) were less likely to disclose their HIV status than younger men and older men were less self-efficacious in their perceived ability to disclose.

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Research also reports that as many as 36–52% of HIV-positive men engage in condomless intercourse with HIV-uninfected (nonconcordant) sex partners.[11] In addition, 38% of people living with HIV are at high risk for elevated sexual infectiousness due to unsuppressed virus in blood plasma and/or co-occurring sexually transmitted infections (STIs).[12] People treated with ART are also less likely to use condoms when they believe they are less infectious.[13–15] Thus, beliefs regarding reduced HIV infectiousness may extend beyond relaxed pressure to use condoms by justifying nondisclosure to HIV-negative and unknown HIV status sex partners.

Studies show that a significant number of people living with HIV engage in condomless intercourse with nondisclosed to partners. One study of HIV-positive alcohol users in Haiti found that 61% of people living with HIV had not disclosed their HIV status to sex partners, and individuals with multiple sex partners in a 3-month period were significantly less likely to have disclosed their HIV status.[16] These rates of disclosure to sex partners are similar to those observed among HIV-infected youth, where 67% report not disclosing their HIV status to first-time sex partners.[17] There is also evidence suggesting that HIV status disclosure should be considered within a broader context of sexual risk reduction communications skills. For example, Latkin et al.[18] found that disclosure of same sex relationships within one's social network was associated with HIV status disclosure. These findings mesh with previous research that shows people with HIV who have more confidence in their capacity to disclose HIV status under difficult conditions (i.e., self-efficacy) are more likely to do so in their relationships.[19]

Ronn et al.[20] developed a conceptual framework for sexually adaptive behaviors in response to HIV infection among men who have sex with men. Drawing from ecological models, the framework includes intrapersonal factors, such as viral load and sexual behavior intentions, as well as interpersonal factors, including HIV status disclosure. Identifying factors that underpin HIV status disclosure to uninfected sex partners will guide interventions to increase protective behaviors among people living with HIV. In the current study, we examined condomless anal and vaginal intercourse in the context of disclosing HIV status to partners among HIV-infected men. We used electronic daily diary procedures to collect sexual behavior data that included HIV status disclosure as well as knowledge of partners' HIV status. Using a prospective study design, we examined infectiousness beliefs (i.e., believing that people with HIV are less infectious when treated with ART) in relation to engaging in condomless sex with uninfected and undisclosed to partners. In addition, we analyzed HIV status disclosure self-efficacy and risk reduction communication skill enactments as predictors of engaging in condomless intercourse with nondisclosed to uninfected partners. We hypothesized that infectiousness beliefs, disclosure self-efficacy, and risk reduction communication skills would independently predict nondisclosed nonconcordant condomless sex.

## Methods

### *Participants and setting*

A total of 804 men living with HIV were recruited from community services and infectious disease clinics during a 12-month period between 2013 and 2014. Venue recruitment relied on responses to brochures placed in waiting rooms of HIV service providers and infectious disease clinics throughout Atlanta, GA. Eligible participants were age 18 years or older and showed documentation of being HIV positive (e.g., antiretroviral medication prescription, HIV test result, viral load laboratory result, HIV clinic card) along with a photo ID. Daily diary data collected over a 28-day period (described below) were used to determine participants' sexual activity, indicating that 538 (66%) participants engaged in anal or vaginal intercourse with at least one partner during that period. The current study focuses on the 538 sexually active men in this sample. The site of the study, Atlanta, GA, has an annual incidence of 30.3 per 100,000, exceeding the 19.6 per 100,000 population rate of HIV in major US cities. The state of Georgia's HIV disclosure law reads ''Any person who knows that he or she is HIV infected is guilty of a felony if he or she, without first disclosing his or her HIV status, (a) knowingly has sexual intercourse or performs or submits to any sexual act involving the sex organs of one person and the mouth or anus of another person; (b) knowingly shares a hypodermic needle or syringe with another person; (c) offers or consents to perform an act of sexual intercourse for money; (d) solicits another to perform or submit to an act of sodomy for money; or (e) donates blood, blood products, other body fluids, or any body organ or body part.'' Violation of the law is a felony punishable by imprisonment for not more than 10 years [Ga. Code Ann. § 16-5-60(c)]. Participants were reimbursed $145 for completing all measures and providing all data. The University of Connecticut Institutional Review Board approved all procedures.

### *Measures*

Participants provided five sources of data: (a) audio-computer-assisted self-interviews (ACASI); (b) medical record abstracted HIV RNA (viral load) and CD4 cell counts; (c) urine specimens to screen for drug use; (d) unannounced pill counts to monitor ART adherence; and (e) 28-daily sexual behavior electronic diary assessments. The specific measures are described below.

Audio-computerized interviews. ACASI assessed demographic and health characteristics, HIV status disclosure self-efficacy, risk reduction communication strategies, and infectiousness beliefs. We used computerized interviews because they have been shown to increase responses to socially sensitive measures.[21,22]

*Demographic and health characteristics.* Computerized interviews asked participants their gender identity, age, years of education, income, ethnicity, employment status, and the year that they first tested HIV positive. Participants reported whether they were currently taking ART, and as an indicator of engagement in care, whether they knew the results of their most recent CD4 cell count and HIV viral load test.[23] We assessed whether participants had been tested and diagnosed with gonorrhea, chlamydia, syphilis, herpes simplex virus, or trichomoniasis in the previous 3 months. Both STI testing and diagnoses were dichotomously coded as present (1) or not present (0). To assess global alcohol use, we administered the Alcohol Use Disorders Identification Test (AUDIT), a scale

designed to measure alcohol consumption and problem drinking, scores >8 indicate potential problem drinking.[24] The Centers for Epidemiological Studies Depression scale (CESD) was used to assess depression symptoms.[25] Items focused on how often a participant had depressive thoughts, feelings, and behaviors in the last 7 days. Responses were 0 = 0 days, 1 = 1–2 days, 2 = 3–4 days, 3 = 5–7 days. Scores range from 0 to 60 and scores greater than 16 indicate possible depression, alpha = 0.89.

*Disclosure self-efficacy.* Four items assessed self-efficacy for disclosing HIV status to sex partners. We used guidelines offered by Bandura[26] to develop items that reflected varying degrees of difficulty disclosing HIV status to unknown, new, and current sex partners, as well as disclosure when drinking alcohol. The self-efficacy items are presented in the Results section. Each situation for disclosure was followed by the statement ''how certain are you that you could decide about telling a partner your status before having sex'' and were responded to on an 11-point scale, 0 = not at all certain, 10 = very certain, alpha = 0.91.

*Risk reduction communication strategies.* Participants indicated whether they had used any of the four risk reduction communication strategies in the previous 3 months. The risk reduction strategies concerned negotiating safer sex and were considered independent of HIV disclosure. The specific communications are shown in the Results section and each was responded to dichotomously, 1 = Yes, 0 = No. We summed the communication skills to create a single index of enacted skills, alpha = 0.79.

*Infectiousness beliefs.* Participants responded to five items assessing beliefs about HIV treatments and routine viral load testing in relation to reducing HIV infectiousness.[27] The items asked whether HIV treatments make sex safer and whether an undetectable HIV viral load alleviates concerns about HIV transmission. Responses were made on a five-point scale, ''Strongly agree,'' ''Agree,'' ''Uncertain,'' ''Disagree,'' and ''Strongly disagree.'' Scores were calculated as mean responses, alpha = 0.79.

Medical chart abstracted viral load and CD4 cell counts. We used a participant-assisted method for collecting chart abstracted viral load and CD4 cell counts from medical records. Participants were given a form that requested their doctor's office to provide results and dates of their most recent, and not older than 3 months, viral load and CD4 cell counts. These data were therefore obtained directly by the participant from their care provider. The form included a place for the provider's office stamp or signature to assure data authenticity. Providers used viral load testing with a range of sensitivities for detecting viral activity. HIV RNA below detection was defined as less than 100 copies per milliliter for uniformity across providers.[28] Participants were given the form following their computerized interview and could return it to the research office during the course of the 28-day study period.

Screening for drug use. To screen for drug use, we conducted a multipanel urine dip-test to detect common illicit drug use. This test strip uses a lateral flow chromatographic immunoassay for qualitative detection of 12 drugs/metabolites, including THC, cocaine, and methamphetamine (Reditest-12; Redwood Toxicology Labs). These tests are FDA approved and are reliable and valid for initial drug screening. A positive result for any drug defined current use.

Antiretroviral adherence. Participants completed three unannounced telephone-based pill counts that occurred over a 1-month period. Unannounced pill counts are reliable and valid in assessing medication adherence when conducted in homes[29] and on phones.[30,31] In this study, we conducted unannounced cell phone-based pill counts using study-provided free cell phones. Following an office-based training session that included a full accounting of all prescription medications, participants were called at three unscheduled times over 12- to 16-day intervals. All antiretroviral medications were included in the pill counts and calculation of adherence. The first of the three pill counts is used to establish the initial number of pills in possession with the subsequent two pill counts allowing for calculation of adherence, defined as the ratio of pills counted relative to pills prescribed, taking into account the number of pills dispensed.[32,33]

Sexual behavior electronic diaries. We used an interactive text-diary assessment to collect daily sexual behavior data. Participants were instructed in the use of text message functions of their study-provided cell phone. Brief daily assessments were designed and delivered using interactive short message system response. Electronic diaries have provided reliable data collection of socially sensitive behaviors.[34,35] Participants received a text-prompt to initiate and answer questions about their sexual activity during the previous day. The questions specifically asked about whether participants had sex yesterday and, if so, whether they engaged in vaginal or anal intercourse with or without condoms, whether they or their partner used alcohol or other drugs, whether their partner was aware of their HIV status, and their knowledge of their partner's HIV status. Each behavior was dichotomous, indicating that it had occurred (coded 1) or not occurred (coded 0). Sex behaviors were recorded by entering numerical responses using the cell phone keypad. The data were stored on a central secured server. Sexual behavior assessments were administered for 28 consecutive days following the initial office assessment and sexual activity was aggregated across days. Studies have demonstrated that aggregated day-level assessments of behavior yield more valid and reliable estimates than recalled intervals of behavior.[36]

### *Data analyses*

Analyses included the 538 participants who reported vaginal or anal intercourse with at least one sex partner during the 28 days of electronic daily diary assessments. Using daily diary data to determine participants' knowledge of their sex partner's HIV status, we compared 372 men who did not engage in sex without condoms with uninformed HIV-negative/unknown status partners to 166 men who engaged in condomless sex without disclosing to their HIV-negative/unknown status partners. From this point forward, we refer to these two groups as the comparison and nondisclosure groups, respectively. For descriptive group comparisons, we used contingency table chi-square ($\chi^2$) tests for

categorical variables and independent groups *t*-tests for continuous variables. Because these analyses were mostly descriptive, we set the level of significance at $p < 0.05$ and did not correct for multiple comparisons. Our main a priori study hypothesis was tested in a multivariable logistic regression, with nondisclosure and comparison groups entered as the dependent variable and HIV status disclosure self-efficacy, risk reduction communication skill enactments, and HIV infectiousness beliefs entered as predictors. For logistic regressions, we report adjusted odds ratios and 95% confidence intervals.

## Results

Response rates to the daily sex behavior diaries were high, with the entire sample of 808 participant-sent 22,512 daily text assessments and completing nearly 21,000 (93%) daily surveys. Daily assessments indicated that 538 (66%) men in our study reported sexual activity in the prospective 28-day assessment period. Among these men, 166 (32%) engaged in condomless sex with an HIV nonconcordant partner in that time period. Table 1 shows the descriptive characteristics of the nondisclosure and comparison groups. Overall, nearly one in five participants (18%) was less than 75% adherent to ART and one in three participants (35%) had chart abstracted unsuppressed HIV. In addition, substance use was common in this sample, with 45% of participants indicating problem drinking and 56% screening positive for active drug use. Engaging in condomless sex with undisclosed-to-nonconcordant partners was associated with higher incomes, more years of education, poorer ART adherence, and a greater likelihood of unsuppressed HIV.

### *Sexual behaviors and partner characteristics*

Table 2 shows the rates of sexual behaviors and partner-related behaviors for the sample over the 28-day observation period. One in five participants engaged in sex with both male and female partners. We found that individuals who did not disclose their HIV status to at least one condomless partner were significantly more likely to have male and female partners and more likely to have regular partners. With respect to their most recent sex partner, the nondisclosure group was nearly twice as likely to have not discussed their most recent partner's HIV status. In addition, 26% of men in the comparison group did not disclose their HIV status to their most recent partner but had used condoms. Overall, participants who engaged in condomless undisclosed nonconcordant

Table 1. Characteristics of People Living with HIV Who Did Not and Who Did Engage in Nondisclosed HIV Status Condomless Sex with HIV-Negative/Unknown Status Partners

| | *Comparison group* (n = *372*) | | *Nondisclosure group*[a] (n = *166*) | | |
|---|---|---|---|---|---|
| *Characteristic* | n | % | n | % | $\chi^2$ |
| Transgender | 25 | 7 | 7 | 4 | 1.2 |
| African American | 350 | 94 | 149 | 90 | 3.2 |
| Income <$10,000 | 235 | 64 | 86 | 52 | 6.5** |
| Unemployed/disability | 297 | 79 | 120 | 71 | 4.9 |
| Treated with ART | 330 | 89 | 147 | 89 | 0.1 |
| Pill count adherence[b] | | | | | |
| <75% adherent | 59 | 19 | 39 | 28 | 4.4* |
| <85% adherent | 105 | 34 | 54 | 39 | 0.9 |
| <95% adherent | 175 | 57 | 91 | 66 | 3.0† |
| Knows viral load | 212 | 57 | 91 | 55 | |
| Believes undetectable viral load[c] | 167 | 79 | 69 | 76 | 0.4 |
| Chart undetectable viral load | 247 | 70 | 99 | 62 | 3.6* |
| Chart detectable viral load | 104 | 30 | 61 | 38 | |
| Tested for STI past 3 months | 182 | 49 | 92 | 55 | 1.9 |
| Diagnosed STI past 3 months | 66 | 18 | 36 | 22 | 3.0 |
| Alcohol use past month | 243 | 66 | 118 | 71 | 1.6 |
| AUDIT >7 | 175 | 47 | 76 | 47 | 0.1 |
| Drug screen positive | 196 | 55 | 94 | 58 | 0.4 |
| | M | *SD* | M | *SD* | t |
| Age | 43.8 | 11.5 | 43.8 | 9.6 | 0.1 |
| Years education | 12.8 | 1.7 | 13.2 | 1.7 | 2.3** |
| Years HIV+ | 13.2 | 8.7 | 14.4 | 8.5 | 1.6 |
| CD4 cell count | 465.4 | 271.8 | 442.1 | 265.4 | 0.9 |
| HIV symptoms | 3.5 | 3.4 | 3.8 | 3.6 | 0.9 |
| CESD depression | 17.9 | 6.5 | 18.3 | 6.4 | 0.6 |

[a]Engaged in undisclosed condomless nonconcordant sex.
[b]Among men receiving ART.
[c]Among men stating they knew their viral load.
†$p < 0.1$; *$p < 0.05$; **$p < 0.01$.
ART, antiretroviral therapy; AUDIT, Alcohol Use Disorders Identification Test; CESD, Centers for Epidemiological Studies Depression scale; STI, sexually transmitted infection.

Table 2. Twenty-Eight-Day Prospective Sexual Behaviors Among People Living with HIV Who Did Not and Who Did Engage in Undisclosed Condomless Sex with HIV-Negative/Unknown Status Partners

| | *Comparison group* (n = *372*) | | | *Nondisclosure group*[a] (n = *166*) | | | |
|---|---|---|---|---|---|---|---|
| *Sexual partners and behaviors* | | n | *%* | | n | *%* | $\chi^2$ |
| Exclusive male partners | | 268 | 72 | | 102 | 61 | |
| Exclusive female partners | | 33 | 9 | | 18 | 11 | |
| Male and female partners | | 71 | 19 | | 46 | 27 | 5.0** |
| Regular sex partner | | 246 | 66 | | 132 | 80 | 9.8** |
| Disclosed to at least one partner | | 160 | 87 | | 5 | 8 | n/a |
| Disclosed to all partners | | 126 | 43 | | 12 | 7 | 65.3** |
| | Σ | M | *SD* | Σ | M | *SD* | t |
| Anal intercourse | 405 | 1.1 | 2.5 | 567 | 3.4 | 3.5 | 8.6** |
| Vaginal intercourse | 188 | 0.5 | 1.1 | 252 | 1.5 | 2.2 | 6.8** |
| Anal or vaginal intercourse | 593 | 1.4 | 2.6 | 819 | 4.3 | 3.8 | 10.3** |
| Nonconcordant intercourse | 162 | 0.4 | 1.3 | 541 | 3.2 | 3.4 | 13.5** |
| Undisclosed nonconcordant | — | — | — | 494 | 2.9 | 3.2 | n/a |
| Substance use before sex | 210 | 1.2 | 2.5 | 313 | 1.8 | 2.9 | 2.1* |

[a]Engaged in undisclosed condomless nonconcordant sex.
*$p < 0.05$; **$p < 0.01$.

intercourse reported 541 days of condomless nonconcordant intercourse compared to 162 days reported by participants in the comparison group.

### *Disclosure self-efficacy, risk reduction communication skills, and infectiousness beliefs*

Men in the nondisclosure group had significantly higher scores on the infectiousness beliefs scale, indicating a stronger endorsement of beliefs that it is safe for HIV-uninfected persons to engage in condomless intercourse with HIV-positive persons who are receiving ART and have undetectable viral loads (Table 3). Across the HIV disclosure scenarios, men in the nondisclosure group were significantly less confident that they could disclose their HIV status to partners. Finally, participants in the nondisclosure group were also significantly less likely to have communicated with sex partners using all four risk reduction strategies, including expressing a need to use condoms, refusing condomless intercourse, discussing condoms, and negotiating safety.

Table 3. Disclosure Self-Efficacy, Infectiousness Beliefs, and Risk Reduction Communications Among Men Living with HIV Who Did Not and Who Did Engage in Undisclosed Condomless Sex with HIV-Negative/Unknown Status Partners

| | *Comparison group* (n = *372*) | | *Nondisclosure group*[a] (n = *166*) | | |
|---|---|---|---|---|---|
| *Beliefs* | M | *SD* | M | *SD* | t |
| Infectiousness beliefs | 1.9 | 0.8 | 2.2 | 0.8 | 3.0** |
| Self-efficacy beliefs | | | | | |
| Disclosure self-efficacy to unknown status partner before sex | 7.3 | 3.1 | 6.5 | 3.1 | 2.7** |
| Self-efficacy to discuss HIV status with a new sex partner | 7.4 | 3.1 | 6.6 | 3.3 | 2.4** |
| Self-efficacy for disclosing HIV status to a current sexual relationship partner | 7.8 | 3.0 | 6.9 | 3.2 | 3.0** |
| Disclosure self-efficacy to a new sex partner after drinking | 7.3 | 3.2 | 6.4 | 3.3 | 2.7** |
| *Risk reduction communications* | n | *%* | n | *%* | $\chi^2$ |
| Told partner need to use condoms | 274 | 73 | 92 | 55 | 17.5** |
| Refused condomless sex | 224 | 60 | 70 | 42 | 15.0** |
| Discussed using condoms | 273 | 73 | 107 | 65 | 4.4* |
| Agreed ahead of time on sexual risks | 206 | 69 | 91 | 55 | 9.4** |

[a]Engaged in undisclosed condomless nonconcordant sex.
*$p < 0.05$; **$p < 0.01$.

*Multivariable model*

We constructed a multivariable logistic regression model to test our primary hypothesis that infectiousness beliefs, risk reduction communication skill enactments, and disclosure self-efficacy would predict engaging in undisclosed condomless anal intercourse with HIV nonconcordant partners. Controlling for income and years of education, we found that the model was significant, $\chi^2 = 43.3$, $p < 0.001$, correctly classifying 71% of participants. As shown in Table 4, condomless undisclosed nonconcordant intercourse was significantly related to all three factors: infectiousness beliefs, risk reduction communication skill enactments, and disclosure self-efficacy.

## Discussion

The current study found that among sexually active men living with HIV, nearly one in three did not disclose their HIV status to non-HIV-positive sex partners with whom they had condomless vaginal or anal intercourse. Men who engaged in condomless nondisclosed sex also demonstrated poorer ART adherence, were more likely to have detectable HIV viral loads, and more likely to use alcohol or drugs during sex than their counterparts in the comparison group. In addition, one in five men in the nondisclosed group had recently been diagnosed with an STI. All of these factors are indicative of greater HIV infectiousness among men who did not disclose their HIV status to condomless HIV nonconcordant sex partners. These findings are consistent with previous studies that have identified factors associated with nondisclosure of HIV, which include poor retention in care and depression.[37,38] Over the course of 28 days, men recorded 1412 days during which they engaged in condomless vaginal and anal intercourse, of which half involved nonconcordant partners. As shown in the results among men with nondisclosed nonconcordant partners, 541 of the 819 days (66%) in which they recorded sexual activity were with nonconcordant partners. Taken together, these factors demonstrated high risk for HIV transmission to uninformed partners.

Men who engaged in condomless nondisclosed sex demonstrated significantly less confidence in their ability to disclose their HIV status to sex partners. We observed lower self-efficacy for disclosure to partners across all of the situational domains assessed. In addition, the nondisclosure group was less likely to have talked with partners about condoms, refused sex without condoms, discussed condoms, and negotiated safer sex behaviors. The consistency observed in self-efficacy and risk reduction communication suggests that failure to disclose HIV status represents at least, in part, a behavioral deficit that extends beyond the challenges of telling sex partners of one's HIV status.

Table 4. Multivariable Model Predicting Condomless Sex with Undisclosed HIV-Negative/Unknown Status Partners

| *Variable* | *Adjusted OR* | *95% CI* |
|---|---|---|
| Income | 1.44 | 0.96–2.17 |
| Education | 1.11 | 0.98–1.26 |
| HIV infectiousness beliefs | 1.41** | 1.11–1.79 |
| Disclosure self-efficacy | 0.90** | 0.84–0.96 |
| Risk reduction communications | 0.79** | 0.69–0.89 |

**$p < 0.01$.
CI, confidence interval; OR, odds ratio.

Demographically, our sample is consistent with previous research that has found older men less likely to disclose their HIV status and lower in self-efficacy beliefs than younger men.[10] In addition, beliefs that sex is safer as a result of ART and HIV suppression were also associated with nondisclosure. Results from the multivariable model showed that these three factors, disclosure self-efficacy, risk reduction communication skills, and infectiousness beliefs, independently contribute to condomless sex in the context of nondisclosure to nonconcordant sex partners. Communication self-efficacy, behavioral skills, and infectiousness beliefs are all viable targets for risk reduction interventions with sexually active HIV-positive men.

The current study should be interpreted in light of its methodological limitations.

This study relied on a convenience sample that cannot be considered representative of men living with HIV infection. The sample also came from a wide range of providers that likely varied in sexual health services and approaches to treating HIV infection. Although the sexual behavior data were collected using reliable daily assessments, these data may still be subject to reporting biases. Socially sensitive and even illegal behaviors, particularly nondisclosure of HIV status to sex partners in the state where this study was conducted, may have been underreported. Thus, rates of nondisclosure, condomless sex, and STI diagnoses in this study should be considered lower bound estimates or best case scenarios. In addition, although we collected sexual behaviors at the day level, we did not collect other key variables, including infectiousness beliefs, self-efficacy, and sexual communications at the day level, precluding day-level analyses. Future studies should capture multiple dimensions at the day or even event levels to allow for more precision in statistical modeling. With these limitations in mind, we believe that our study findings have implications for implementing early HIV treatment as an HIV prevention strategy.

The pattern of results suggests that men who find it difficult to disclose their HIV status to sex partners may justify their behavior by beliefs of lower infectiousness in the age of ART being used for prevention. However, these beliefs are likely false for men who are nonadherent to ART, have unsuppressed HIV, and contract co-occurring STI—all factors that increase HIV infectiousness.[1,39,40] Misinformed beliefs and deficits in disclosure self-efficacy and risk reduction skills suggest promising avenues for interventions. Cognitive and behavioral interventions that focus on correcting misinformation and building risk reduction and communication skills have a long history of demonstrated efficacy in HIV prevention,[41,42] including interventions designed to reduce HIV transmission risks among men living with HIV.[43] However, there are surprisingly few interventions designed to assist people living with HIV to manage HIV disclosure to sex partners.

In a comprehensive review of interventions to promote HIV disclosure to sex partners, Conserve et al.[44] identified five trials, three of which suggested efficacious results. While promising, the interventions were delivered in multiple small group sessions that have proven difficult to implement in

clinical settings. Furthermore, it is common for case managers and other providers to face regulatory requirements for reviewing HIV disclosure laws with their clients, and even have clients certify that they are aware of the law by signing a form. These requirements now exist in a context where medical providers may inform their patients that sex is safer when they have undetected HIV in their blood plasma, rendering them less infectious or noninfectious.

We therefore conclude that high rates of undisclosed condomless sex are occurring in a context of legal requirements to disclose HIV status that are at odds with messages that sex is safer when HIV is treated. In addition, factors associated with nondisclosure, such as beliefs and self-efficacy, are amenable to well-established principles of behavior change.[26] Clinical messages should therefore both inform patients of local laws and build skills for managing HIV disclosure decisions in sexual relationships through open discussions, behavioral rehearsal role plays, and feedback to overcome barriers to disclosure.

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