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## Transmission Risk among Youth Living with HIV in the United States

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### Abstract

**Purpose:** HIV treatment as prevention is effective for reducing the risk of HIV transmission and the messaging campaign, Undetectable = Untransmittable (U=U), is gaining recognition. Since youth living with HIV (YLWH) who have condomless sex may acquire and potentially transmit other sexually transmitted infections (STIs), the purpose of this study was to assess potential differences in transmission risk of HIV and other STIs among YLWH to inform subsequent HIV and STI prevention efforts.

**Methods:** A cohort of 600 HIV behaviorally-infected youth aged 13–24 who were engaged in medical care completed an audio computer-assisted self-interview including questions about demographics, HIV disclosure, mental health, substance use, and sexual behaviors and beliefs. HIV viral loads and the presence of other STIs were abstracted from medical records. A viral load

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< 200 copies/mL was considered undetectable. Univariate and bivariate analyses were conducted to examine differences by viral load and STIs.

**Results:** Participants were categorized into four groups: 1) undetectable without STIs (55.2%); 2) undetectable with STIs (14.2%); 3) detectable without STIs (22.8%); and 4) detectable with STIs (7.8%). In comparison to the other three groups, youth in the undetectable group with STIs reported more favorable sexual risk-reduction attitudes and beliefs, internet use for finding sex partners, anal sex with male partners, and condomless anal sex with male partners.

**Conclusions:** YLWH with undetectable viral loads and other STIs engaged in higher risk behaviors. In order to realize the promise of the messaging campaign, U=U, efforts must focus on sustained viral suppression and prevention of STIs among YLWH.

### Keywords

sexually transmitted infections; viral load suppression; youth living with HIV; HIV Continuum of Care; Treatment as Prevention; Undetectable = Untransmittable

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There has been a clear and growing consensus that when persons living with HIV (PLWH) achieve viral suppression their risk of sexual HIV transmission is essentially eliminated [1]. The Prevention Access Campaign's strongly endorsed consensus statement indicates that "people living with HIV on antiretroviral therapy (ART) with an undetectable viral load in their blood have a negligible risk of sexual transmission of HIV" and that "HIV viral suppression should be monitored to assure both personal health and public health benefits" [2]. Their Undetectable = Untransmittable or U=U campaign has been endorsed by the Centers for Disease Control and Prevention (CDC), the National Institutes of Health, and several other groups [2,3].

Successful medical care for HIV that results in sustained viral suppression not only prevents sexual HIV transmission but also averts the development of AIDS. Youth are a population greatly impacted by HIV both nationally and globally, and youth living with HIV (YLWH) are a key population to identify and treat [4]. In the United States (US), there were an estimated 50,900 YLWH with 44% unaware of their HIV serostatus at the end of 2016 [4]. Current prevention and treatment strategies have focused on the sequential steps along the HIV Continuum of Care (CoC) from initial diagnosis to linkage and retention in care to ART to viral suppression [5]. Among YLWH in 2015, it has been reported that 36% received some HIV care, 27% were retained in care, and only 25% were virally suppressed, the lowest percentages for any age group in the US [4]. Prior research has shown that measuring a single point in time for viral suppression is not sufficient for YLWH, and has suggested that an additional step of Sustained Suppression be added to the CoC for YLWH [6].

It is evident that HIV diagnosis and treatment must remain a top priority for youth. Still, there is also a distinct population of YLWH in the US who are receiving needed HIV medical care. Effective HIV treatment on both an individual and population level may allow a secondary focus on other medical conditions that YLWH can acquire and transmit, such as other sexually transmitted infections (STIs).

Engagement in condomless vaginal or anal sexual behaviors by YLWH contribute to new STIs in the US. Prior research has shown that some adolescents and young adults who are living with HIV practice condomless anal or vaginal sexual activities with HIV-negative or unknown HIV serostatus sexual partners [7–13]. A review of the literature on condom use among male and female YLWH in the US showed that 40–60% reported engaging in condomless sex [14]. Several factors have been identified in previous work as being associated with condomless sex among YLWH including high frequency of finding sex partners online, substance use, and mental health problems [15,16]. Other research has found that positive sexual risk-reduction attitudes and beliefs, increased self-efficacy for sexual risk-reduction, and HIV disclosure are all associated with engaging in consistent condom use [17,18].

Consistent condom use may have varying importance in preventing STIs. Among YLWH who have detectable HIV viremia, the presence of another STI implies that there may have also been risk for HIV transmission. The purpose of this secondary data analysis was to evaluate prevalence and risk factors for STIs among YLWH in the US with and without viral load suppression. We sought to explore potential differences in socio-demographics, sexual risk-reduction attitudes and beliefs, self-efficacy for sexual risk-reduction, HIV disclosure, finding sex partners online, sexual behaviors, mental health, and substance use among YLWH who fell into one of four categories of “transmission risk” based on HIV viral suppression and prevalence of another STI to guide public health intervention efforts and maximize the potential of the campaign, U=U.

## Methods

This secondary data analysis is part of a parent study in The Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN), “ATN 125 PHASES -Provision of HIV Treatment at ATN Sites: An Evaluation for Stakeholders,” conducted to evaluate the success of initial and ongoing treatment among YLWH at 14 academic medicine clinics affiliated with the ATN located in mostly urban areas throughout the US with a high HIV disease burden. The details of the study have been described elsewhere [6,19,20].

### Participants and Recruitment:

Participants were recruited between February 2015 and February 2016. Youth were eligible to participate in the study if they were: a) between the ages of 13 and 24; b) behaviorally HIV-infected (defined as infection with HIV through sexual behaviors or injection drug use); c) currently receiving or planning to receive HIV medical care at one of the participating clinics; d) proficient in verbal and/or written English; and e) willing to allow research staff to access their medical records. Each of the participating sites received approval from their individual Institutional Review Boards (IRBs) to conduct the study.

### Study Procedures:

Youth were approached by research staff to assess study interest and eligibility; those eligible were invited to participate. Signed informed consent was obtained from the individual, or assent with signed parental/legal guardian permission as determined by the

local IRB. Upon consent, an audio-computer assisted self-interview (ACASI) was completed at baseline that included questions about demographics, sexual risk-reduction attitudes and beliefs, self-efficacy for sexual risk-reduction, HIV disclosure, finding sex partners online, sexual behaviors, mental health, and substance use. Participants were given a modest monetary incentive determined by each of the participating sites' IRB.

Over the course of six months, research staff reviewed medical charts and abstracted documentation of any STI including: Chlamydia, Gonorrhea, *Lymphogranuloma Venereum*, *Trichomonas Vaginalis*, and Pelvic Inflammatory Disease. Syphilis and Herpes were not included in this analysis as these can both be chronic or latent infections. Charts were also abstracted for HIV viral load measures. A 6-month study period was defined for each participant, and the start of their study period was the date of their study enrollment visit. To be included in the analyses, participants needed to have at least six months of follow-up data after enrollment and to have at least one HIV viral load during their 6-month study period.

## Measures

**Demographic characteristics:** Participants' demographics included age, gender identity, race/ethnicity, education, income (past 30-days), housing status (stable or marginal with marginal defined as living in a foster home or group home, in a rooming, boarding, halfway house, or a shelter/welfare hotel, on the street(s)), and number of incarcerations.

**Sexual risk-reduction attitudes and beliefs:** Participants completed an 11-item measure that assesses attitudes and beliefs toward risk-reduction strategies including serosorting, strategic positioning, and viral load level (example items: "I purposely look for other HIV positive people to have sex with"; "If my viral load is low or undetectable I am less likely to infect another person with HIV if I have unprotected sex."). Items were rated by participants on a 4-point Likert-type scale (1 = "Strongly disagree" to 4 = "Strongly agree"). Items were summed such that higher scores indicate more favorable attitudes and beliefs toward these three risk-reduction strategies. This scale has been used in prior work with YLWH [18], and demonstrated adequate psychometric properties in this sample ( $\alpha = 0.79$ ).

**Self-efficacy for sexual risk-reduction:** Participants read four different stories in which they evaluated their level of self-efficacy or confidence in their ability to engage in risk-reduction strategies during sex: 1) while under the influence of alcohol; 2) when feeling lonely; 3) with an ex-partner; and 4) with a long-term partner who does not want to use condoms. Items (e.g., "How confident are you that you could make an effective decision of whether to tell this person you are HIV positive in this situation?" and "How confident are you that you could bring up the need to practice safer sex in this situation?") were rated by participants on a 10-point Likert-type scale (0 = "Cannot do at all" to 10 "Certain to do") for each scenario. Items were summed such that higher scores indicate higher levels of self-efficacy for risk-reduction. This measure has been used in a past study with YLWH [18]. Cronbach's alpha for the current study was 0.85.

**HIV disclosure:** Participants were asked to report (0 = “No” and 1 = “Yes”) if they had revealed their HIV status to anyone and to whom they had disclosed (e.g., current sex partner, past sex partner, current steady boyfriend or girlfriend, past steady boyfriend or girlfriend).

**Finding sex partners online.**—One question asked participants to identify if they had used the Internet in the past six months to search for a sex partner. Responses were either 0 = “No” and 1 = “Yes”.

**Sexual behaviors:** Questions assessed number of partners in the past six months, and whether participants had engaged in sexual activity (e.g., vaginal or anal) by partner HIV status (e.g., HIV-positive or HIV-negative/unknown) and gender identity (e.g., male or female). We created a series of binary variables to examine differences in each of the transmission risk groups and different sexual behaviors.

**Mental health:** Participants completed two subscales from the Brief Symptom Inventory (BSI) [21], which included the 6-item anxious symptom subscale ( $\alpha=0.89$ ) and the 6-item depressive symptom subscale ( $\alpha=0.88$ ). Items have the following response options: 0 = “Not at all”, 1 = “A little bit”, 2 = “Moderately”, 3 = “Quite a bit”, and 4 =

“Extremely.” Each subscale was summed such that greater values indicate higher levels of symptoms.

**Substance use:** Participants completed the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), which assess alcohol, marijuana, and other drug use [22]. The ASSIST includes frequency in the prior 3 months for alcohol, cannabis, and other drug use (e.g., cocaine, amphetamines, inhalants, sedatives, hallucinogens, opioids, and other drugs). Participants indicate the frequency of use with the categories of “Never”, “Once or Twice”, “Monthly”, “Weekly”, and “Daily.”

**Transmission Risk:** Research staff abstracted information from each participant’s medical record regarding any diagnosis of Chlamydia, Gonorrhea, *Lymphogranuloma Venereum*, *Trichomonas Vaginalis*, and Pelvic Inflammatory Disease. Participants with one or more STIs during the study period were classified as having an STI. Viral load data was also abstracted from the participant’s medical record. Participants with at least 1 viral load > 200 copies/ mL during their 6-month study period were classified as detectable. In total, 20.5% of participants with an undetectable viral load had an STI and 25.5% of participants with a detectable viral load had an STI. A four-category variable for transmission risk was created to categorize participants into the following groups: 1) undetectable without STIs; 2) undetectable with STIs; 3) detectable without STIs; and 4) detectable with STIs.

## Statistical Analysis

Descriptive statistics were calculated for all variables included in the analyses including the distribution of scales, with appropriate tests for normality (e.g., skewness). There was minimal missing data (i.e., 2 participants did not report their race/ethnicity and 1 participant did not report history of incarceration). Given the minimal missing data, case-wise deletion

was used for missing values. We then examined bivariate associations between study variables and: 1) the 4-category transmission risk group variable and 2) separately for gender and race/ethnicity using analysis of variance with post-hoc tukey tests and chi-square tests. All analyses were conducted with SPSS v.25.

## Results

Participants ranged in age from 13 to 24 years ( $M = 21.4$ ,  $SD = 2.0$ ). As shown in Table 1, the majority of the sample identified as male (78.5%) and non-Hispanic Black (73.7%). The sample was relatively low in indicators of socioeconomic status, such that nearly two-thirds of the sample had a high school degree/general education diploma (GED) or less (63.6%) and earned less than \$1,000 in the past month (67.3%). Participants had a total of 1,100 viral load results during the 6-month study period with 40% having 1 viral load, 42% having 2 viral loads, and 18% having 3–6 viral loads.

Participants reported engaging in insertive and receptive condomless anal sex with male partners at overall rates of 30% and 29% respectively, with significantly higher rates of 45% and 39% among youth who tested positive for one or more STIs and were virally suppressed. Rates of HIV non-disclosure averaged across all four groups were highest for current casual sex partners (72%), medium for past casual sex partners (62%), and lowest for current or past steady sex partners (44%), with no difference in these rates among youth who were and were not virally suppressed.

Table 2 presents bivariate comparisons examining differences in the 4-category transmission risk group by demographic characteristics, sexual risk-reduction attitudes and beliefs, self-efficacy for sexual risk-reduction, HIV non-disclosure, finding sex partners online, sexual behaviors, mental health, and substance use. In terms of demographics, significant factors included education, housing, and incarceration history. There were significant differences in sexual risk-reduction attitudes and beliefs and internet use to find sex partners. Post-hoc Least Significant Difference (LSD) comparisons illustrated that youth in the undetectable group with STIs had significantly higher scores compared to youth in the other groups. A greater proportion of youth in the undetectable group with STIs reported using the internet to find sex partners compared to the other groups.

There were also significant mean differences with respect to sexual partners. Post-hoc LSD comparisons illustrated youth in the undetectable group with STIs reported a significantly greater number of total and male sex partners compared to those in the other groups. In addition, a greater proportion of youth in the undetectable group with STIs reported: any anal sex with male partners, any insertive anal sex with male partners, any insertive condomless sex with male partners, any receptive anal sex with male partners, and any receptive condomless sex with male partners compared to youth in the other three groups. No significant differences were noted for self-efficacy for sexual risk-reduction, HIV status non-disclosure, mental health, or substance use across the four groups.

Lastly, we explored whether there were differences by gender and racial/ethnic identity in study variables as shown in Tables 3 and 4. Although both cisgender and transgender women

were underrepresented in this sample, we did find small but significant differences between cisgender men and women in their sexual risk-reduction attitudes and beliefs. Significant differences in HIV non-disclosure to casual sexual partners and Internet use for finding sex partners were also observed for both gender and race/ethnicity. In addition, the total number of sexual partners significantly differed for gender identity but not race/ethnicity.

## Discussion

Our study includes several important findings. First, among a sample of youth receiving medical care in the US, YLWH with undetectable viral loads who have other STIs are a group engaging in more sexual risk behaviors than other YLWH. Second, the group of YLWH who have other STIs endorsed the most favorable attitudes toward their own ability to engage in sexual risk reduction. Third, rates of HIV non-disclosure among YLWH are highest for current casual sex partners, medium for past casual sex partners, and lowest for current or past steady sex partners, with no difference in these rates among youth who were and were not virally suppressed.

In this study, we found a large percentage of YLWH were engaging in insertive and receptive condomless anal sex with male partners, especially in the group who were virally suppressed and also tested positive for one or more STIs. We also found favorable endorsement of items on the measure of sexual risk-reduction attitudes and beliefs. For example, we found high agreement with the following statement: “If my viral load is undetectable, I am less likely to infect another person with HIV if I have unprotected sex.” Condomless sex in this population will not lead to HIV transmission as long as viral suppression is maintained. However, this finding raises concern as sexual risk behavior is associated with acquiring and/or transmitting other STIs. Additionally, risk for HIV transmission may still be present as sustained viral suppression among youth may not be consistently achieved.

It is also important to point out that the majority of our participants did not disclose their HIV status to past or current casual sexual partners. Although the finding of non-disclosure among YLWH is not new, it is interesting that there was no difference in rates of disclosure among youth who were virally suppressed as compared to those who were detectable. It is possible that YLWH who are virally suppressed may not feel that it is necessary to disclose their HIV status to their partners because they are not currently infectious. On the contrary, prior research has found that youth are not often accurate in knowing whether they are detectable or undetectable [26]. Thus, strategies that promote frequent viral load monitoring are needed to optimize the U=U campaign.

The U=U campaign endorsed by the CDC and other health organizations around the world as a prevention method indicates that PLWH who are undetectable will not transmit HIV to uninfected sexual partners [23]. In particular, the CDC states that PLWH adherent to ART as prescribed who achieve and maintain an undetectable viral load (200 copies/mL or less) have essentially no risk of HIV transmission to uninfected sexual partners [24]. According to the Prevention Access Campaign, this message has powerful implications that may help to: 1) reduce PLWH’s potential concern regarding transmitting HIV to others; 2) destigmatize

PLWH as being promiscuous, irresponsible, or possibly dangerous; 3) encourage PLWH to initiate and stay on treatment to improve or maintain their health; and 4) support universal access to treatment and care for all PLWH [25].

The U=U movement is an important step toward helping to end the HIV pandemic in that it links HIV prevention with HIV treatment. Beyond the undetectable U, there are essentially two options. Once someone achieves initial viral load suppression they can either maintain viral suppression or not. A lack of sustained viral suppression can be due to non-adherence to treatment or the emergence of a resistant virus. It is important that messages about the benefit of achieving initial viral suppression be coupled with the need for PLWH to continually monitor and sustain viral suppression over time. Durable viral suppression is critical for YLWH, but difficult to achieve. In fact, prior analyses from this study showed that over 40% of YLWH who achieved suppression were unable to maintain viral suppression at one year [6]. Notably, those with histories of incarceration, substance use, and home instability were particularly at risk for treatment failure [6]. YLWH need effective linkage to care and support to stay engaged in care.

Our findings are subject to some limitations. First, our findings may not generalize to other YLWH because the participants in our sample were currently engaged in care at one of our participating clinics in the ATN. YLWH who are receiving treatment at a non-ATN affiliated site or who are not currently in care may be different than those in care at one of the participating sites. In addition, this study focused on behaviorally-infected youth so our findings may not generalize to youth infected perinatally. Second, our data was primarily collected through self-report, which is subject to recall bias and social desirability bias. However, we minimized these effects by using ACASI with all of our participants in the study [27–30]. Third, the study protocol did not include routine screening for STIs and relied solely on documentation of STIs in medical records. It is possible that this is a minimization of the number of STIs among youth in this sample. Fourth, in calculating our transmission risk variable we did not distinguish between oral, genital and anal STIs and acknowledge that this may not take into account their individual potential impact on HIV transmission.

Despite these limitations, our study has several strengths that include having a large national dataset of YLWH in the US who are engaged in medical care. Abstracted medical records for these participants have provided information about viral loads and STIs. Additionally, ACASI interviews have allowed us to learn about their attitudes and beliefs. The results suggest that youth with undetectable viral loads who have contracted STIs are engaging in behavior that puts them at higher risk for STI acquisition and transmission than other YLWH who are engaged in medical care.

Though the U=U campaign may be oversimplified, its elegance stems from the clear linkage of treatment and prevention. HIV care providers are increasingly being asked to take on not only the care of their patient, but also the care of their patient's sexual partners, at least when it comes to preventing HIV. Findings from this study highlight additional opportunities for HIV prevention, especially among those with HIV who test positive for another STI. Initial and then sustained suppression need close monitoring and the addition of sustained



suppression to the HIV CoC cascade would highlight the importance of this metric. Further, the role of risk reduction, specifically disclosure and condom use in the presence of STIs, need to be clarified in the era of U=U. Great strides have been made in both HIV treatment and prevention, but evidence of risky behavior among YLWH who have viral suppression and other STIs highlights an important area for further research.

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### List of Abbreviations (in alphabetical order):

<b>ACASI</b>	audio-computer assisted self-interview
<b>AIDS</b>	acquired immunodeficiency syndrome
<b>ART</b>	antiretroviral therapy
<b>ASSIST</b>	Alcohol, Smoking and Substance Involvement Screening Test
<b>ATN</b>	Adolescent Medicine Trials Network for HIV/AIDS Interventions
<b>BSI</b>	Brief Symptom Inventory
<b>CDC</b>	Centers for Disease Control and Prevention
<b>CoC</b>	Continuum of Care
<b>GED</b>	general education diploma
<b>HIV</b>	human immunodeficiency virus
<b>IRB</b>	Institutional Review Boards

<b>LSD</b>	Least Significant Difference
<b>PLWH</b>	persons living with HIV
<b>STIs</b>	sexually transmitted infections
<b>U=U</b>	undetectable= untransmittable
<b>US</b>	United States
<b>YLWH</b>	youth living with HIV

## References

- Centers for Disease Control and Prevention (CDC). Evidence of HIV treatment and viral suppression in preventing the sexual transmission of HIV. December 2018 Available at: <https://www.cdc.gov/hiv/pdf/risk/art/cdc-hiv-art-viral-suppression.pdf> Accessed November 14, 2019.
- Prevention Access Campaign. Messaging Primer & Consensus Statement. Risk of sexual transmission of HIV from a person living with HIV who has an undetectable viral load. Updated: May 5, 2019 Available at: <https://www.preventionaccess.org/consensus> Accessed November 14, 2019.
- Eisinger RW, Dieffenbach CW, Fauci AS. HIV viral load and transmissibility of HIV infection: undetectable equals untransmittable. *JAMA*. 2019 1 10. doi: 10.1001/jama.2018.21167. [Epub ahead of print]
- CDC. HIV among youth. Updated April 2019 Available at: <https://www.cdc.gov/hiv/pdf/group/age/youth/cdc-hiv-youth.pdf> Accessed November 14, 2019.
- Gardner EM, McLees MP, Steiner JF, et al. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis*. 2011;52:793–800. DOI: 10.1093/cid/ciq243. [PubMed: 21367734]
- Lally MA, van den Berg JJ, Westfall AO, et al. HIV continuum of care for youth in the United States. *J Acquir Immune Defic Syndr*. 2018;77:110–117. DOI: 10.1097/QAI.0000000000001563. [PubMed: 28991884]
- Murphy DA, Durako SJ, Moscicki AB, et al. No change in health risk behaviors over time among HIV infected adolescents in care: role of psychological distress. *J Adolesc Health*. 2001;29:57–63. DOI: 10.1016/S1054-139X(01)00287-7 [PubMed: 11530304]
- Outlaw AY, Naar-King S, Janisse H, et al. Predictors of condom use in a multisite study of high-risk youth living with HIV. *AIDS Educ Prev*. 2010;22:1–14. DOI: 10.1521/aeap.2010.22.1.1. [PubMed: 20166783]
- Tanney MR, Naar-King S, Murphy DA, et al. Multiple risk behaviors among youth living with human immunodeficiency virus in five U.S. cities. *J Adolesc Health*. 2010;46:11–16. DOI: 10.1016/j.jadohealth.2009.05.017. [PubMed: 20123252]
- Koenig LJ, Pals SL, Chandwani S, et al. Sexual transmission risk behavior of adolescents with HIV acquired perinatally or through risky behaviors. *J Acquir Immune Defic Syndr*. 2010;55:380–390. DOI: 10.1097/QAI.0b013e3181f0ccb6. [PubMed: 20802343]
- Mellins CA, Tassiopoulos K, Malee K, et al. Behavioral health risks in perinatally HIV-exposed youth: co-occurrence of sexual and drug use behavior, mental health problems, and nonadherence to antiretroviral treatment. *AIDS Patient Care STDS*. 2011;25:413–422. DOI: 10.1089/apc.2011.0025. [PubMed: 21992620]
- Bauermeister JA, Elkington KS, Robbins RN, et al. A prospective study of the onset of sexual behavior and sexual risk in youth perinatally infected with HIV. *J Sex Res*. 2012;49:413–422. DOI: 10.1080/00224499.2011.598248. [PubMed: 21797715]
- Clum GA, Chung SE, Ellen JM, et al. Victimization and sexual risk behavior in young, HIV positive women: exploration of mediators. *AIDS Behav*. 2012;16:999–1010. DOI: 10.1007/s10461-011-9931-0. [PubMed: 21452050]

14. Carter MW, Kraft JM, Hatfield-Timajchy K, et al. The reproductive health behaviors of HIV-infected young women in the United States: A literature review. *AIDS Patient Care STDS*. 2013;27:669–680. DOI: 10.1089/apc.2013.0208. [PubMed: 24320012]
15. Nugent NR, Brown LK, Belzer M, et al. Youth living with HIV and problem substance use: elevated distress is associated with nonadherence and sexual risk. *J Int Assoc Physicians AIDS Care*. 2010;9:113–115. DOI: 10.1177/1545109709357472.
16. Rice E, Batterham P, Rotheram-Borus MJ. Unprotected sex among youth living with HIV before and after the advent of highly active antiretroviral therapy. *Perspect Sex Reprod Health*. 2006;38:162–167. DOI: 10.1363/psrh.38.162.06. [PubMed: 16963390]
17. Sturdevant MS, Belzer M, Weissman G, et al. The relationship of unsafe sexual behavior and the characteristics of sexual partners of HIV infected and HIV uninfected adolescent females. *J Adolesc Health*. 2001;29:64–71. DOI: 10.1016/S1054-139X(01)00286-5. [PubMed: 11530305]
18. van den Berg JJ, Fernández MI, Fava JL, et al. Using syndemics theory to investigate risk and protective factors associated with condomless sex among youth living with HIV in 17 U.S. cities. *AIDS Behav*. 2017;21:833–844. DOI: 10.1007/s10461-016-1550-3. [PubMed: 27624727]
19. van den Berg JJ, Javanbakht M, Gorbach PM, et al. Partner notification for youth living with HIV in 14 cities in the United States. *J Acquir Immune Defic Syndr*. 2018;77:46–52. DOI: 10.1097/QAI.0000000000001565. [PubMed: 29023252]
20. Gamarel KE, Nichols S, Kahler CW, et al. A cross-sectional study examining associations between substance use frequency, problematic use and STIs among youth living with HIV. *Sex Transm Infect*. 2018;94:304–308. DOI: 10.1136/sextrans-2017-053334. [PubMed: 29180537]
21. Derogatis LR. *BSI Brief Symptom Inventory: Administration, Scoring, and Procedures Manual*. Bloomington, MN: PsychCorp; 1993.
22. World Health Organization Assist Working Group. The alcohol, smoking and substance involvement screening test (ASSIST): development, reliability and feasibility. *Addiction*. 2002;97:1183–1194. DOI: 10.1046/j.1360-0443.2002.00185.x. [PubMed: 12199834]
23. The Lancet HIV. U=U taking off in 2017. *Lancet HIV* 2017;4:e475 DOI: 10.1016/S2352-3018(17)30183-2.
24. CDC. HIV treatment as prevention. Accessed at: <https://www.cdc.gov/hiv/risk/art/index.html> 11 14, 2019.
25. Prevention Access Campaign. Why is U=U Important? Accessed at: <https://www.preventionaccess.org/about> 11 14, 2019.
26. Mustanski B, Ryan DT, Remble TA, et al. Discordance of self-report and laboratory measures of HIV viral load among young men who have sex with men and transgender women in Chicago: implications for epidemiology, care, and prevention. *AIDS Behav*. 2018;22:2360–2367. DOI: 10.1007/s10461-018-2112-7. [PubMed: 29637386]
27. Kissinger P, Rice J, Farley T, et al. Application of computer-assisted interviews to sexual behavior research. *Am J Epidemiol*. 1999;149:950–954. DOI: 10.1093/oxfordjournals.aje.a009739 [PubMed: 10342804]
28. Des Jarlais DC, Paone D, Milliken J, et al. Audio-computer interviewing to measure risk behaviour for HIV among injecting drug users: a quasi-randomised trial. *Lancet*. 1999;353:1657–1661. DOI: 10.1016/s0140-6736(98)07026-3. [PubMed: 10335785]
29. Johnson AM, Copas AJ, Erens B, et al. Effect of computer-assisted self-interviews on reporting of sexual HIV risk behaviours in a general population sample: a methodological experiment. *AIDS*. 2001;15:111–115. DOI: 10.1097/00002030-200101050-00016 [PubMed: 11192852]
30. Kurth AE, Martin DP, Golden MR, et al. A comparison between audio computer-assisted self-interviews and clinician interviews for obtaining the sexual history. *Sex Transm Dis*. 2004;31:719–726. DOI: 10.1097/01.olq.0000145855.36181.13. [PubMed: 15608586]

**Implications and Contribution:**

Virally suppressed youth may be less concerned with transmitting HIV but are still at risk for other STIs. This study documented that youth with undetectable viral loads who contracted STIs were more likely to engage in risky behaviors, suggesting the U=U campaign must reinforce sustained viral suppression and condom use.

**Table 1.**

Demographic characteristics of the sample (N=600)

Demographics	Mean (SD) or n (%)
<b>Age</b>	21.4 (2.0)
<b>Age at HIV diagnosis</b>	18.8 (2.3)
<b>Gender</b>	
Male	471 (78.5%)
Female	109 (18.2%)
Transgender woman	20 (3.3%)
<b>Race/Ethnicity*</b>	
Black/non-Hispanic	441 (73.7%)
Hispanic/Latino	109 (18.2%)
Other/non-Hispanic	30 (5.0%)
White/non-Hispanic	18 (3.0%)
<b>Education</b>	
Less than high school	126 (21.0%)
High school or GED	256 (42.6%)
Some college/In college	169 (28.1%)
Master's degree or higher	49 (8.3%)
<b>Income (past 30 days)</b>	
None or less than \$50	120 (20.0%)
\$51 to \$249	101 (16.8%)
\$250 to \$499	82 (13.7%)
\$500 to \$999	101 (16.8%)
\$1,000 to \$5,000 or more	111 (18.5%)
Refuse/Don't know	85 (14.2%)
<b>Housing</b>	
Stable	559 (93.2%)
Marginal	41 (6.8%)
<b>Number of incarcerations*</b>	
0	377 (62.9%)
1 time	106 (17.7%)
2-5 times	89 (14.9%)
6 or more times	27 (4.5%)

\* Note: Missing values: Race/ethnicity = 2; Number of incarcerations = 1

**Table 2.**

Bivariate comparisons by the four category STI transmission risk variables

Characteristic/Measure	Undetectable without STIs		Undetectable with STIs		Detectable without STIs		Detectable with STIs		Test statistic
	n=331	n (%) or Mean (SD)	n=85	n (%) or Mean (SD)	n=137	n (%) or Mean (SD)	n=47	n (%) or Mean (SD)	
<b>Demographics</b>									
<b>Age</b>									
	21.47 (1.94)		21.14 (2.16)		21.45 (1.98)		20.96 (2.31)		F (3, 597)=1.35, p=0.257
<b>Age at HIV diagnosis</b>	18.90 (2.19)		18.96 (2.04)		18.81 (2.36)		18.26 (2.82)		F(3, 597)=1.22, p=0.301
<b>Gender</b>									$\chi^2$ (6)=18.15, p=0.01
Male	257 (77.6)		78 (91.8)		99 (72.3)		37 (78.7)		
Female	62 (18.7)		7 (8.2)		34 (24.8)		6 (12.8)		
Transgender woman	12 (3.6)		0		4 (2.9)		4 (8.5)		
<b>Education</b>									
Less than high school	53 (16.0)		16 (18.8)		43 (31.2)		14 (29.8)		$\chi^2$ (9)=25.47, p=0.01
High school or GED	155 (46.5)		31 (36.5)		54 (39.1)		17 (36.2)		
Some college/in college	97 (29.3)		25 (29.4)		34 (24.6)		13 (27.7)		
Master's degree or higher	26 (7.9)		13 (15.3)		6 (4.3)		3 (6.4)		
<b>Housing</b>									
Marginal Housing	14 (4.2)		8 (9.4)		12 (8.8)		7 (14.9)		$\chi^2$ (3)=9.95, p=0.02
Stable Housing	316 (95.8)		77 (90.6)		125 (91.2)		40 (85.1)		
<b>Number of incarcerations</b>									
0	227 (68.6)		56 (66.7)		67 (48.9)		27 (57.4)		$\chi^2$ (9)=29.80, p=0.001
1 time	54 (16.3)		16 (19.0)		25 (18.2)		11 (23.4)		
2-5 times	42 (12.7)		8 (9.5)		31 (22.6)		8 (17.0)		
6 or more times	8 (2.4)		4 (4.8)		14 (10.2)		1 (2.1)		
<b>Sexual risk-reduction attitudes and beliefs</b>	26.98 (7.1) <sup>a</sup>		30.32 (11.5) <sup>b</sup>		26.87 (7.2) <sup>a</sup>		27.09 (5.9) <sup>a</sup>		F(3, 597)=4.50, p=0.001
<b>Self-efficacy for sexual risk reduction</b>	88.76 (20.01)		82.84 (20.78)		88.20 (20.81)		83.82 (23.59)		F(3, 597)=2.35, p=0.072
<b>HIV non-disclosure</b>									
Current casual sexual partners	220 (78.9)		55 (72.4)		84 (75.0)		24 (63.2)		$\chi^2$ (3)=5.25, p=0.154

Characteristic/Measure	Undetectable without STIs n=331 n (%) or Mean (SD)	Undetectable with STIs n=85 n (%) or Mean (SD)	Detectable without STIs n=137 n (%) or Mean (SD)	Detectable with STIs n=47 n (%) or Mean (SD)	Test statistic
Past casual sexual partners	176 (63.1)	46 (63.1)	67 (59.8)	23 (60.5)	$\chi^2 (3)=0.46, p=0.928$
Past/current steady sexual partners	120 (43.0)	34 (44.7)	53 (47.3)	15 (39.5)	$\chi^2 (3)=0.95, p=0.815$
<b>Internet use for finding sex partners</b>	107 (32.3)	48 (56.5)	43 (31.4)	20 (42.6)	$\chi^2 (6)=26.16, p=0.001$
<b>Sexual behaviors</b>					
Number of male partners	3.70 (6.32) <sup>a</sup>	6.64 (12.88) <sup>b</sup>	4.61 (7.21) <sup>a</sup>	5.61 (7.42) <sup>a</sup>	$F(3,597)=2.86, p=0.04$
Number of female partners	2.00 (3.22)	2.50 (4.55)	2.04 (3.96)	1.25 (1.28)	$F(3,597)=2.35, p=0.903$
Number of total partners	3.78 (6.30) <sup>a</sup>	6.79 (13.33) <sup>b</sup>	4.77 (7.64) <sup>a</sup>	5.44 (7.25) <sup>a</sup>	$F(3,597)=2.91, p=0.03$
Any anal sex with male partners	164 (49.5)	60 (70.6)	70 (50.7)	25 (53.2)	$\chi^2 (3)=12.53, p=0.01$
Any insertive anal sex with male partners	152 (45.9)	56 (65.9)	60 (43.5)	25 (53.2)	$\chi^2 (3)=12.95, p=0.01$
Any insertive condomless anal sex with male partners	88 (26.6)	38 (44.7)	40 (29.0)	13 (27.7)	$\chi^2 (3)=10.81, p=0.01$
Any receptive anal sex with male partners	139 (42.0)	50 (58.8)	60 (43.5)	25 (53.2)	$\chi^2 (3)=9.07, p=0.03$
Any receptive condomless anal sex with male partners	80 (23.2)	33 (38.8)	43 (31.2)	17 (36.2)	$\chi^2 (3)=9.25, p=0.03$
Any anal/vaginal sex with female partners	23 (6.9)	4 (4.7)	10 (7.2)	2 (4.3)	$\chi^2 (3)=1.08, p=0.783$
Any condomless anal/vaginal sex with female partners	12 (3.6)	3 (3.5)	7 (5.1)	0	$\chi^2 (3)=2.57, p=0.463$
<b>Depressive Symptoms</b>	7.26 (6.46)	8.51 (6.68)	8.00 (6.43)	9.06 (7.73)	$F(3,597)=1.75, p=0.156$
<b>Anxious Symptoms</b>	5.45 (5.89)	6.05 (5.91)	6.23 (5.96)	7.38 (7.05)	$F(3,597)=1.69, p=0.168$
<b>Alcohol, past 3 months</b>					$\chi^2 (9)=15.63, p=0.075$
Daily/Almost Daily	13 (3.9)	2 (2.4)	5 (3.6)	4 (8.5)	
Weekly	61 (18.5)	24 (28.6)	24 (17.5)	13 (27.7)	
Once or twice monthly	198 (60.0)	46 (54.8)	72 (52.6)	24 (51.1)	
Never	58 (17.6)	12 (14.3)	36 (26.3)	6 (12.8)	
<b>Marijuana, past 3 months</b>					
Daily/Almost Daily	91 (27.7)	30 (35.7)	44 (32.1)	22 (46.8)	$\chi^2 (9)=12.15, p=0.205$
Weekly	30 (9.1)	8 (9.5)	14 (10.2)	5 (10.6)	
Once or twice monthly	73 (22.2)	15 (17.9)	28 (20.4)	6 (12.8)	

Characteristic/Measure	Undetectable without STIs n=331	Undetectable with STIs n=85	Detectable without STIs n=137	Detectable with STIs n=47	Test statistic
	n (%) or Mean (SD)	n (%) or Mean (SD)	n (%) or Mean (SD)	n (%) or Mean (SD)	
Never	135 (41.0)	31 (36.9)	51 (37.2)	14 (29.8)	$\chi^2 (9)=16.94 p=0.152$
<b>Any Other Drug, past 3 months</b>					
Daily/Almost Daily	4 (1.2)	3 (3.5)	0	0	
Weekly	7 (2.1)	4 (4.7)	3 (2.2)	2 (4.3)	
Once or twice monthly	56 (16.9)	15 (17.6)	33 (23.9)	13 (27.7)	
Never	262 (79.2)	61 (71.8)	101 (73.2)	32 (68.1)	

\* Note: STIs = sexually transmitted infections; Means having different superscripts differ from each other significantly at the  $p < .05$  level by Tukey comparison (for continuous variables).



**Table 3.**

Bivariate comparisons of study variables by gender identity

Characteristic/Measure	Female n (%) or Mean (SD)	Male n (%) or Mean (SD)	Trans women n (%) or Mean (SD)	Test statistic
<b>Sexual risk-reduction attitudes and beliefs</b>				
<b>Self-efficacy for sexual risk reduction</b>	25.35 (6.55) <sup>a</sup> 85.09 (21.52)	27.91 (8.15) <sup>b</sup> 88.25 (20.30)	27.55 (5.25) 80.26 (23.03)	F(2,597)=4.77, p=0.009 F(2,597)=2.20, p=0.112
<b>HIV non-disclosure</b>				
Current casual sexual partners	2 (11.2)	110 (27.5)	2 (12.5)	$\chi^2$ (2)=11.74, p=0.003
Past casual sexual partners	23 (25.8)	167 (41.8)	3 (18.8)	$\chi^2$ (2)=10.45, p=0.004
Past/current steady sexual partners	54 (60.7)	222 (55.5)	7 (43.8)	$\chi^2$ (2)=1.80, p=0.406
<b>Internet use for finding sex partners</b>	3 (2.8)	211 (44.8)	4 (20.0)	F(2, 597)=70.64, p=0.000
<b>Sexual behaviors</b>				
Number of total partners	2.36 (5.53) <sup>a</sup>	4.95 (8.26) <sup>b</sup>	7.27 (13.88) <sup>b</sup>	F(2, 597)=4.28, p=0.014

\* Note: Means having different superscripts differ from each other significantly at the  $p < .05$  level by Tukey comparison (for continuous variables).

**Table 4.**

Bivariate comparisons study variables by race/ethnicity

Characteristic/Measure	Hispanic	Black Non-Hispanic	Other Race Non-Hispanic	White Non-Hispanic	Test statistic
	n (%) or Mean (SD)	n (%) or Mean (SD)	n (%) or Mean (SD)	n (%) or Mean (SD)	
<b>Sexual risk-reduction attitudes and beliefs</b>					
<b>Self-efficacy for sexual risk reduction</b>	28.74 (7.99)	27.19 (7.92)	26.60 (4.30)	27.06 (9.73)	F(3, 597)=1.27, p=0.285
<b>Self-efficacy for sexual risk reduction</b>	84.13 (21.09)	88.54 (20.14)	83.03 (23.66)	86.06 (24.25)	F(3, 597)=1.79, p=0.148
<b>HIV non-disclosure</b>					
Current casual sexual partners	29 (30.9)	77 (21.1)	11 (42.3)	5 (27.8)	$\chi^2$ (3)=8.94, p=0.03
Past casual sexual partners	45 (47.9)	126 (34.5)	14 (53.8)	8 (44.4)	$\chi^2$ (3)=8.79, p=0.032
Past/current steady sexual partners	59 (62.8)	192 (52.6)	7 (73.1)	7 (61.1)	$\chi^2$ (3)=6.72, p=0.082
<b>Internet use for finding sex partners</b>	53 (48.6)	151 (34.2)	8 (26.7)	6 (33.3)	F(3, 597)=41.44, p=0.000
<b>Sexual behaviors</b>					
Number of total partners	4.28 (4.29)	4.49 (8.60)	4.89 (7.47)	9.43 (15.32)	F(3, 597)=1.72, p=0.162

\* Note: Means having different superscripts differ from each other significantly at the  $p < .05$  level by Tukey comparison (for continuous variables).