Published in final edited form as:

J Acquir Immune Defic Syndr. 2009 August 1; 51(4): 470–485. doi:10.1097/QAI.0b013e3181a2810a.

Social and Behavioral Correlates of Sexually Transmitted Infection– and HIV-Discordant Sexual Partnerships in Bushwick, Brooklyn, New York

Maria R. Khan, PhD^{*,†}, Melissa Bolyard, PhD[‡], Milagros Sandoval, BA^{*}, Pedro Mateu-Gelabert, PhD^{*}, Beatrice Krauss, PhD[§], Sevgi O. Aral, PhD^{||}, and Samuel R. Friedman, PhD^{*}

^{*}National Development and Research Institutes, New York, NY

[†]Public Health Solutions, New York, NY

[‡]Emory College of Arts and Sciences, Atlanta, GA

[§]Center on AIDS, Drugs, and Community Health, CUNY-Hunter, New York, NY

^{||}Centers for Disease Control and Prevention, Atlanta, GA

Abstract

Introduction—The Centers for Disease Control and Prevention (CDC) advise repeat HIV testing for partners of HIV-infected persons; injection drug users and their sex partners; individuals with recent multiple partnerships and their sex partners; those involved in sex trade; and men who have sex with men. Additional social and behavioral variables may be useful for identifying priority populations.

Methods—We analyzed data collected during a social network study conducted in a Brooklyn, NY, neighborhood to identify social and behavioral characteristics of respondents (N = 343) involved in HIV-discordant, herpes simplex virus-2– discordant, and chlamydia-discordant partnerships.

Results—HIV partnership discordance was associated with injection drug use but was generally not associated with sexual behaviors including multiple partnerships and sex trade. herpes simplex virus-2 and chlamydia partnership discordance were associated with multiple partnerships, sex trade, and same sex partnership history. Additional correlates of sexually transmitted infection (STI)/HIV–discordant partnerships included older age (> 25 years), noninjection drug use, and incarceration history. Analyses suggested that screening tools composed of CDC-recommended sexual risk and injection drug indicators plus indicators of older age, noninjection drug use, and incarceration were more effective in identifying STI/HIV priority populations than tools composed of CDC indicators alone.

Conclusions—Screening tools that include social and behavioral indicators may improve STI/HIV case-finding effectiveness.

Copyright © 2009 by Lippincott Williams & Wilkins

Correspondence to: Maria R. Khan, PhD, National Development and Research Institutes, 71 West 23rd Street, New York, NY 10010 (maria_khan@unc.edu).

A version of this article was presented in an oral presentation at the XXVIII International Sunbelt Social Network Conference, January 26, 2008, St Pete Beach, FL.

Keywords

Bushwick; discordant partnerships; HIV; sexual behavior; sexually transmitted infections; social factors; substance use

INTRODUCTION

In 2006, the Centers for Disease Control and Prevention (CDC) released revised recommendations for HIV testing in health care settings in the United States, advising routine HIV testing for all adults aged 13–64 years and repeat HIV testing for those considered at high risk of HIV.¹ High-risk individuals were identified as partners of HIV-infected persons; injection drug users (IDUs) and their sex partners; those who themselves or whose partners had recent multiple partnerships; those who exchange sex for money or drugs; and men who have sex with men (MSM). This list may fail to identify some populations at risk of sexually transmitted HIV. Research was needed to determine whether a more comprehensive set of behavioral and social indicators would identify additional populations in need of HIV testing and prevention. Given the importance of sexually transmitted infection (STI) in increasing HIV transmission risk² and as a clear public concern in the United States in itself,³ identification of social and behavioral indicators that may improve STI case-finding was also needed.

We investigated social and behavioral factors associated with STI or HIV risk among a predominantly minority population in Bushwick, Brooklyn, a low-income neighborhood of approximately 100,000 residents with high rates of poverty, crime, injection drug use (IDU), and STI/HIV.^{4–6} To identify individual and partner factors associated with STI/HIV or exposure to infection, data are needed in which both members of the sexual partnership are interviewed and provide biospecimens for STI/HIV testing. Sexual network studies provide these data.^{7–11} We used data from the Networks, Norms, and HIV Risk among Youth study (NNAHRAY), a network study whose primary aims were to identify links between high-risk and low-risk individuals in Bushwick and to measure how the network structure has influenced patterns of infection.^{12,13} The aim of this substudy was to measure the association between social and behavioral indicators and sexual partnership with a partner infected with HIV, herpes simplex virus-2 (HSV-2), and/or Chlamydia among those testing negative for these infections. These associations are of interest to help target at-risk individuals and their partners for testing and other interventions.

METHODS

Networks, Norms and HIV Risk Among Youth

Recruitment for NNAHRAY has been described in detail elsewhere.^{12,13} From June 2002 through August 2005, 465 young adults aged 18 years and older were recruited, including 112 index cases and 353 identified risk contacts. Briefly, index cases were recruited from 3 sources of Bushwick residents: a household-based representative sample aged 18–30 years ($n = 69$), a convenience sample of IDUs ($n = 35$), and a convenience sample of group sex event participants ($n = 8$). Each index case was asked to identify and provide locator information for risk contacts including sexual partners in the past 3 months (> 10 partners); partners with whom the respondent injected drugs in the past 3 months, even if syringes/equipment were not shared (> 5 IDU partners); or a person with whom the respondent attended a group sex event (> 8 contacts). Multiple waves of network tracing were performed to obtain the sample of risk contacts.

Eligible participants who were successfully located by NNAHRAY staff and who provided written informed consent were enrolled. Staff administered a 1-hour structured face-to-face sexual behavior and drug use survey; collected 10 mL of blood and 10 mL of urine for STI/HIV testing; and provided a cash incentive (\$20 for the interview, \$10 for blood, and \$10 for urine). As described previously,¹³ a venous blood sample was tested for HIV using HIV enzyme-linked immunosorbent assay (Abbott Laboratories, Abbott Park, IL) and Western blot (BioRad Laboratories, Hercules, CA) and for HSV-2 using type-specific enzyme-linked immunosorbent assay (HerpeSelect, Focus Technologies, Cypress, CA). Urine was tested for chlamydia using nucleic acid amplification (BDProbeTec ET CT/GC Amplified DNA Assays; BD Diagnostic Systems, Sparks, MD).

The current study was restricted to respondents involved in at least 1 sexual partnership in the past 3 months for which interview data for both members of the partnership were available (n = 343 participants). Partnerships could have been identified by 1 or both members of the partnership.

Ethical approval for all procedures was obtained by the Institutional Review Board of the National Development and Research Institutes, Inc.

Measures

STI Discordance and Condom Use in Sexual Partnerships—We measured partnership concordance or discordance for HIV, HSV-2, and chlamydia.

During the survey, when respondents identified a sexual partner, they were also asked to report whether a condom was used with the partner in the past 3 months. The partnership was categorized as a partnership in which condoms were used consistently in the past 3 months if both partners reported condom use during every sex act (when condom use data were available from both members of the partnership) or if 1 partner reported condom use during every sex act (when condom use data were available from only 1 member of the partnership).

Correlates of Sex With an STI/HIV-Infected Partner

Dependent Variables—The 3 dichotomous outcomes were defined as having at least 1 HIV-positive partner in the past 3 months, among those uninfected with HIV; having at least 1 HSV-2-positive partner in the past 3 months, among those uninfected with HSV-2; and having at least 1 partner with chlamydial infection in the past 3 months, among those uninfected with chlamydia.

Explanatory Factors—We explored the association between each outcome and dichotomous indicators of respondent and recent sexual partner variables, including demographic characteristics (age 25 years or older, self-reported black race, and residence outside Bushwick, a mobility indicator); socioeconomic status (less than high school graduation achievement, current unemployment); drug use history (use of noninjected crack, cocaine, or heroin in the past year, and IDU in the past year); and sexual risk history [same sex partnership history, multiple partnerships in the past 3 months, greater than the median lifetime number of partners (20 partners for men, 10 partners for women), sex trade for money or drugs in the past year, and attendance of a group sex event in the past year].

Data Analysis

We performed analyses in Stata Version 9.2 (Stata Corp, College Station, TX). We calculated the partnership-level prevalence of STI/HIV discordance, in which 1 member of

the partnership was infected with a given STI and the other was uninfected, and we measured condom use prevalence within partnerships.

We calculated prevalences and means of sociodemographic and behavioral variables among individuals involved in at least 1 sexual partnership in the past 3 months. We estimated unadjusted and gender-adjusted prevalence ratios (PRs) and 95% confidence intervals (CIs) for the associations between respondent and partner characteristics and sexual partnership with an STI/HIV-infected partner (the outcomes of partnership with an HIV-infected partner, an HSV-2-infected partner, or a partner with chlamydial infection were evaluated separately) using a generalized linear model with probability weights, log link, Poisson distribution without an offset,^{14,15} and a robust variance estimator.¹⁶ In cases where associations differed by gender, as indicated by significance of the gender by exposure product interaction term ($P < 0.15$), gender-specific associations were presented. When estimating associations between partner's age and partnership with an STI/HIV-infected partner, we adjusted for respondent age.

Based on the above analyses, we identified the social and behavioral variables that were the strongest indicators of HIV and HSV-2 discordant partnerships. We assessed whether addition of these indicators to a "CDC Screener," a screening tool composed of CDC indicators of high-risk populations (sexual risk and IDU exposure indicators), would improve identification of priority populations for HIV or HSV-2 testing compared with the use of a "CDC Screener" alone. Specifically, we defined priority populations as HIV or HSV-2-infected individuals and/or those who recently had sex with an HIV- or HSV-2-infected partner. The analytic sample for the assessment excluded IDUs and men who have had sex with at least 1 male sex partner (MSM), populations who already are identified in routine practice as priority populations for STI/HIV screening, because we wished to assess the performance of the screening tools in additional risk populations. The "CDC Screener" included CDC-recommended indicators of high-risk populations that were measured in the NNAHRAY questionnaire, excluding history of IDUs and MSM: respondent perception that a sex partner had an IDU history, respondent report of exchange of sex for drugs or money in the past year, and respondent history of multiple partnerships in the past 3 months. Respondent perception that a recent sex partner had multiple sexual partners, an additional CDC-recommended indicator of high-risk populations, was not assessed during NNAHRAY and hence was not included in the "CDC Screener." We calculated the sensitivity, specificity, and percentage of members of the NNAHRAY network who would be tested for HIV or HSV-2 based on the "CDC screener" and the "CDC screener" plus additional key social and behavioral indicators versus the gold standard, the actual size of the HIV and HSV-2 priority populations determined by HIV and HSV-2 testing conducted during NNAHRAY.

RESULTS

Participant Characteristics

Of 343 NNAHRAY participants involved in at least 1 sexual partnership, in the past 3 months, just over half were male (53%). The mean age among men (33 years) was older than that among women (27 years) (Table 1). The sample was primarily Latino (70%) and black (21%). Nearly three quarters of respondents had ever used noninjected crack, cocaine, or heroin (73%). Thirty-eight percent had ever used injection drugs, all of whom had also used noninjected drugs.

Based on STI/HIV testing, nearly half of respondents were HSV-2 infected (48%), 10% were HIV infected, and 6% had chlamydial infection. Smaller percentages were positive for syphilis (3%) and gonorrhea (1%). Marked gender and racial differences characterized

infection with HSV-2 (non-black women: 56%, nonblack men: 31%, black women: 63%, black men: 67%; $P < 0.001$) and HIV (nonblack women: 5%, nonblack men: 10%, black women: 15%, black men: 24%; $P = 0.016$). No racial or gender differences in the prevalence of chlamydia were observed.

STI/HIV Discordance and Condom Use in Sexual Partnerships

Of the 343 individuals involved in at least 1 sexual partnership in the past 3 months, there were 296 sexual partnerships for whom we had interview data for both members of the partnership; these partnerships were included in the partnership-level analyses. Partnership discordance was greatest for HSV-2 (40%), followed by HIV (13%), and chlamydia (11%) (Table 2). Condoms were used consistently in approximately 37% of partnerships.

Correlates of Sexual Partnership Between STI/HIV-Infected and Uninfected Individuals

Correlates of Sex With an HIV-Infected Partner, Among Those Uninfected With HIV—Sexual partnership in the past 3 months with an HIV-infected individual was strongly associated with respondent older age (> 25 years) (gender-adjusted PR: 3.66, 95% CI: 1.57 to 8.52); incarceration history (gender-adjusted PR: 2.03, 95% CI: 1.06 to 3.92); ever having used noninjected heroin (gender-adjusted PR: 4.38, 95% CI: 2.03 to 9.45), cocaine (gender-adjusted PR: 3.14, 95% CI: 1.27 to 7.75), or crack (gender-adjusted PR: 2.43, 95% CI: 1.27 to 4.65); ever having used injection drugs (gender-adjusted PR: 2.69, 95% CI: 1.49 to 4.86); and history of same sex partnership among men (PR: 2.06, 95% CI: 0.96 to 4.42) (Table 3). In general, respondent sexual risk behaviors such as recent multiple partnerships, sex trade, and group sex event participation were not associated with recent sex with an HIV-positive partner.

Characteristics of HIV-negative respondents' recent sexual partners were strongly associated with respondents' recent sex with an HIV-positive individual. The strongest correlate was having at least 1 partner in the past 3 months who was at least 25 years old (gender and respondent age-adjusted PR: 9.89, 95% CI: 1.16 to 84.3); nearly every person with an HIV-positive partner in the past 3 months had a partner who was at least 25 years old, creating extreme imprecision in the estimate. Other moderate or strong correlates included having at least 1 partner in the past 3 months who was more than 5 years older (gender and respondent age-adjusted PR: 2.54, 95% CI: 1.42 to 4.55), had ever been incarcerated (gender-adjusted PR: 2.03, 95% CI: 1.00 to 4.12), had ever used noninjected crack, cocaine, or heroin (gender-adjusted PR: 4.83, 95% CI: 1.19 to 19.7), had ever used injection drugs (gender-adjusted PR: 6.63, 95% CI: 2.66 to 16.5), reported greater than the median number of lifetime sexual partners (gender-adjusted PR: 3.68, 95% CI: 1.48 to 9.12), was a man who ever had sex with a man (gender-adjusted PR: 5.64, 95% CI: 3.12 to 10.2), and was a woman who had ever had sex with a woman (gender-adjusted PR: 1.81, 95% CI: 1.00 to 3.29).

Correlates of Sex With an HSV-2-Infected Partner, Among Those Uninfected with HSV-2—Few sociodemographic characteristics of HSV-2-negative respondents were strong indicators of sex with an HSV-2-positive partner in the past 3 months (Table 4). Of these, the strongest indicator was history of incarceration among uninfected women (gender-adjusted PR: 2.57, 95% CI: 1.86 to 3.53). Incarceration was not a correlate among men.

Among HSV-2-uninfected respondents, recent sexual and drug use behaviors were associated with recent partnership with an HSV-2-infected individual, with stronger associations observed among women than men. For women, the strongest behavioral correlates of HSV-2 discordance were multiple sexual partnerships in the past 3 months

(gender-adjusted PR: 2.09, 95% CI: 1.25 to 3.51) and history of same sex partnerships (gender-adjusted PR: 1.97, 95% CI: 1.15 to 3.38).

HSV-2–uninfected respondents were at least twice as likely to have had an HSV-2–positive partner in the past 3 months if 1 or more of their partners in the past 3 months was at least 25 years old (gender and respondent age-adjusted PR: 2.02, 95% CI: 1.34 to 3.05); was greater than 5 years old (among HSV-2–uninfected women only, gender and respondent age-adjusted PR: 2.22, 95% CI: 1.26 to 3.92); had ever used noninjection drugs (gender-adjusted PR: 2.47, 95% CI: 1.42 to 4.31); and had a “high” lifetime number of partners (among HSV-2–uninfected men only, gender-adjusted PR: 3.09, 95% CI: 1.68 to 5.69).

Correlates of Sex With a Chlamydia-Infected Partner, Among Those

Uninfected With Chlamydia—Among chlamydia-uninfected respondents, sexual partnership in the past 3 months with at least 1 chlamydia-infected partner was associated with respondent black race (gender-adjusted PR: 2.05, 95% CI: 1.12 to 3.72) (Table 5). Other respondent sociodemographic factors and substance use variables did not seem to be associated with recent sex with a chlamydia-infected partner.

Among women uninfected with chlamydia, recent sex with a chlamydia-infected partner was strongly correlated with sexual behavior variables including same sex partnership history (PR: 6.50, 95% CI: 1.93 to 21.9), multiple partnerships in the past 3 months (gender-adjusted PR: 5.19, 95% CI: 1.54 to 17.5), and sex trade (gender-adjusted PR: 7.61, 95% CI: 2.60 to 22.3).

Among men and women, group sex event attendance was associated with twice the prevalence of recent sex with a partner infected with chlamydia (gender-adjusted PR: 2.03, 95% CI: 1.06 to 3.86).

Chlamydia-uninfected respondents were approximately twice as likely to have had sex in the past 3 months with a chlamydia-infected partner if they had at least 1 sexual partner in the past 3 months who resided outside Bushwick (gender-adjusted PR: 2.14, 95% CI: 1.19 to 3.86), had not graduated from high school (gender-adjusted PR: 2.23, 95% CI: 1.03 to 4.78), had ever been incarcerated (gender-adjusted PR: 2.01, 95% CI: 0.97 to 4.13), or had ever used injection drugs (gender-adjusted PR: 1.98, 95% CI: 1.03 to 3.78) or noninjection drugs (gender-adjusted PR: 2.76, 95% CI: 0.88 to 8.67).

Among those uninfected with chlamydia, sex with a chlamydia-infected partner in the past 3 months was associated with having a recent partner who was a man who had ever had sex with a man (gender-adjusted PR: 3.10, 95% CI: 1.72 to 5.59), was a woman who had ever had sex with a woman (gender-adjusted PR: 4.14, 95% CI: 2.06 to 8.32), had multiple partnerships in the past 3 months (gender-adjusted PR: 17.4, 95% CI: 2.42 to 126), or had a “high” lifetime number of partners (gender-adjusted PR: 6.53, 95% CI: 2.02 to 21.1).

Screening Tools That Include Additional Social and Behavioral Indicators Improve Detection of Priority Populations at Greatest Risk of HIV and/or HSV-2

Among the strongest indicators of HIV- and HSV-2–discordant partnerships were respondent age of 25 years or older, having a recent sex partner who was 25 years or older, respondent non-IDU, and respondent incarceration. We assessed whether addition of these indicators to a “CDC Screener” based on indicators of sex trade, multiple sex partnerships, and sex with an IDU would improve identification of priority non-MSM and non-IDU populations.

For identification of individuals who were HIV infected or who had sex in the past 3 months with an HIV-infected partner, the “CDC Screener” alone was 57% sensitive and 53% specific and would result in HIV testing in 48% of the population; the “CDC Screener” plus an indicator of respondent older age was 95% sensitive and 32% specific and would result in testing 71% of the population; and the “CDC Screener” plus indicators of respondent older age and sex partner’s older age was 100% sensitive and 27% specific and would result in testing 75% of the population (Table 6).

For identification of individuals who were infected with HSV-2 or who had sex in the past 3 months with a partner who was infected with HSV-2, the “CDC Screener” alone was 53% sensitive and 66% specific and would result in HSV-2 testing in 47% of the population; the “CDC Screener” plus an indicator of respondent older age was 81% sensitive and 50% specific and would result in testing 71% of the population; and the “CDC Screener” plus indicators of respondent older age and sex partner’s older age was 85% sensitive and 45% specific and would result in testing 76% of the population. With the addition of respondent non-IDU and incarceration, the screener for HSV-2 priority populations was 90% sensitive and 30% specific and would result in testing 84% of the population (Table 6).

DISCUSSION

The high levels of HSV-2, HIV, and chlamydia discordance measured in this Bushwick population reflected the high prevalence of these infections in the sample, which far exceeded national prevalence levels.^{17–19} Condoms were used in a minority of partnerships. Continued high levels of STI/HIV-discordant sexual partnerships, without improvements in condom use and STI treatment, may lead to further STI/HIV transmission. Improved identification of high-risk populations may prevent growth of the STI/HIV epidemics within this network and expansion into lower risk Bushwick populations and neighboring communities.

To obtain data needed to target STI/HIV interventions, we identified respondent and partner characteristics most strongly associated with HSV-2, HIV, and chlamydia partnership discordance. In this population, the CDC-recommended indicators of sexually transmitted HIV infection risk that were strongly associated with HIV-discordant sexual partnerships included respondent and sexual partner’s IDU. Surprisingly, many of the CDC sexual behavioral indicators were not good markers of potential sexual exposure to HIV, including respondent recent history of multiple sexual partnerships, sex work, or recent sexual partnership with someone who had recently had multiple partners. The weak associations between these sexual behavior indicators and partnership with an HIV-infected sexual partner resulted from high levels of sexual behaviors in the study population as a whole; these sexual risk behaviors were common among those with and without HIV-positive partners.

Our analyses suggested that some variables not recommended by the CDC as priority indicators of sexually transmitted HIV infection risk were strongly associated with HIV partnership discordance. The strongest correlate of HIV discordance was partner’s older age; nearly all HIV-uninfected respondents with a recent HIV-positive partner reported sex with someone who was 25 years or older. Likewise, respondent older age and having a partner who was at least 5 years old was associated with HIV partnership discordance. Age mixing is an established risk factor of STI/HIV.^{7,20–27} Subsequent analyses of NNAHRAY indicated that age mixing was common, suggesting its potential importance for STI/HIV transmission through the network. Just over half (64%) of partnerships in which partners differed in age were male–female partnerships between older men and younger women. The findings imply gender-specific messages emphasizing that the risk of sex with older partners

should reach *both* men and women in this population. Numerous prior studies have documented women's lack of autonomy in sexual relationships and resulting difficulties in negotiating for protected sex;^{28–33} having an older male sex partner may exacerbate this power dynamic. Hence, interventions also should address the particular vulnerability of young women, such as by providing them with negotiating tools in relationships and by addressing sociostructural norms that may create the gender power imbalances.

Non-IDU among respondents and/or their recent sexual partners also was a strong and consistent indicator of HIV-discordant partnerships, a result supporting prior evidence that non-IDU is a strong correlate of HIV infection.^{6,34} Health facilities should systematically provide HIV prevention education and testing to non-IDUs and IDUs. In addition, drug treatment centers are preexisting infrastructures that may allow public health workers to reach populations vulnerable to infection that may otherwise be difficult to reach.

Finally, incarceration history of respondents or their sexual partners was associated with HIV partnership discordance. This finding supports prior evidence of an association between incarceration and HIV^{35–37} and points to the need for STI/HIV prevention efforts among former prisoners and their partners. Prison-based and jail-based STI/HIV interventions should be strengthened and community-based efforts should be designed for partners of those who are currently incarcerated and for newly released prisoners being reintegrated into their communities and social networks.

We also investigated indicators of HSV-2-discordant and chlamydia-discordant partnerships and found that partnership discordance for these infections, as expected, was associated with respondent or partner sexual risk behaviors, including multiple partnerships, sex trade, and involvement in group sex. Additional social and behavioral correlates of discordant partnerships included older partner age, use of noninjection drugs by respondents or their partners, and incarceration history. The findings suggest that assessment of key social and behavioral indicators in addition to traditional markers of sexual risk taking may improve STI case-finding effectiveness.

A very strong correlate of chlamydia partnership discordance—also associated with HSV-2 and HIV partnership discordance—was women's same sex partnership history. This finding supports extant evidence of increased STI/HIV risk among women who have a history of sex with a woman.^{38–41} Transmission of STIs including HIV within female–female partnerships has been documented.⁴² However, most women experienced STI/HIV risk resulting from sex with men; further analysis of the NNAHRAY data indicated that, of the partnerships in which 1 partner was a woman who reported a history of same-sex partnerships (n = 122 partnerships), nearly 90% were male to female partnerships. Women in this study reporting a same sex partnership history may be disproportionately likely to have had an STI/HIV-infected partner as a result of involvement in high-risk sexual behaviors, such as involvement in sex trade, or because they have a sexual network of male and female partners who are more likely to be HIV infected. Community STI/HIV prevention efforts must make special efforts to reach this vulnerable population with information about transmission risks and the need for, and community availability of, STI and drug use screening and treatment. This is particularly important because the potential marginalization of this group may inhibit health seeking behaviors and uptake of prevention messages.⁴¹

We assessed whether the addition of indicators of older age (defined in this population as 25 years or older), non-IDU history, and incarceration history would improve identification of priority populations who should be tested for HIV and HSV-2. We excluded participants who reported a history of IDU or MSM because these populations already are identified in

routine practice as high-risk populations for STI/HIV screening. Our findings suggested that inclusion of these additional indicators could markedly improve the identification of priority populations. For example, if we used a “CDC screener” composed of IDU and sexual risk indicators only, we would have identified just over half of those in need of HIV testing, including those who either were HIV infected or who recently had sex with an HIV-infected individual. If we used a “CDC screener” plus 2 additional indicators—respondent age of 25 years or older or respondent recent sex with a partner who was older—we would have tested 100% of this priority population. The implication is that addition of sociodemographic and other behavioral indicators should be considered when designing tools to identify priority populations to test for infection. By expanding the definition of “high risk,” the specificity of the screening tool will decrease and the number of uninfected individuals who receive testing will increase. However, recent analyses suggest that routine HIV testing for all adults is cost effective except in settings where there is evidence that the prevalence of undiagnosed HIV infection is below 0.02%.⁴³ If the screening tools available to health providers identified a broader range of priority populations—such as by including social and behavioral indicators associated with HIV infection or partnership with an HIV-infected individual—HIV case-finding likely would improve.

Likewise, given the high prevalence of HSV-2,⁴⁴ the dramatic racial disparity in infection,⁴⁴ the importance of HSV-2 as a cofactor of HIV transmission,² and the high proportion of asymptomatic infection,⁴⁵ screening for HSV-2 should be more aggressive. The addition of social and behavioral indicators to HSV-2 screening tools should be considered, and future studies should be conducted to evaluate these tools for case finding and cost effectiveness.²

The results from this study should be interpreted in the context of NNAHRAY study design limitations. First, analysis of these data cannot yield a screening tool that can be used universally, in all US populations, for identification of priority populations for STI/HIV testing. Even though we cannot assume that the specific social and behavioral indicators that were strongly correlated with STI/HIV discordance in Bushwick also will be key indicators in other populations, the implications of this study’s findings are relevant to STI/HIV screening everywhere: addition of only a few additional social and behavioral indicators may greatly improve identification of populations in need of testing. To most effectively identify priority populations in a specific geographic area, screening tools should be adapted based on analyses of transmission dynamics in that specific area.

A second limitation of these data is that months may have elapsed between when the first and second partner were interviewed, hence the behaviors and infection status of each partner measured during data collection may not have represented behavior and infection status at the time when the partnership actually occurred.

Our findings suggested that current indicators typically used to identify those at greatest risk of infection may be inadequate. The analysis indicates that in Bushwick, providers should offer repeat STI/HIV testing to those reporting older partners, personal or partners’ non-IDU, and personal or partners’ incarceration, in addition to those reporting sexual and IDU behaviors. Other large scale and nationally based studies of STI/HIV risk, including CDC’s National HIV Behavioral Surveillance System study on risk factors of heterosexually transmitted HIV, should investigate whether inclusion of additional behavioral and social indicators would enhance screening tools used to identify high-risk populations in need of repeat STI/HIV testing. Doing so may reduce the numbers of STI/HIV-infected individuals who come into contact with the health care system but who fail to be screened, diagnosed, treated, and educated about transmission risks.

Acknowledgments

Supported by the NIDA grant Networks, Norms, and HIV/STI Risk Among Youth (S.R.F., PI, R01DA013128). M.R.K. was supported as a postdoctoral fellow in the Behavioral Sciences Training in Drug Abuse Research program, sponsored by Public Health Solutions and the National Development and Research Institutes, Inc with funding from the National Institute on Drug Abuse (5T32 DA07233).

The authors would like to acknowledge the assistance of the participants in this study.

References

- Centers for Disease Control and Prevention. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *MMWR Recomm Rep*. 2006; 55(RR-14): 7.
- Cohen MS. HIV and sexually transmitted diseases: lethal synergy. *Top HIV Med*. 2004; 12:104–107. [PubMed: 15516707]
- Centers for Disease Control and Prevention. Trends in Reportable Sexually Transmitted Diseases in the United States, 2006: National Surveillance Data for Chlamydia, Gonorrhea, and Syphilis. 2007
- Mahler, L. *Sexed Work: Gender, Race and Resistance in a Brooklyn Drug Market*. Oxford, United Kingdom: Oxford University Press; 1997.
- Friedman, SR.; Curtis, R.; Neaigus, A., et al. *Social Networks, Drug Injectors' Lives, and HIV/AIDS*. New York, NY: Kluwer/Plenum; 1999.
- Friedman SR, Flom PL, Kottiri BJ, et al. Drug use patterns and infection with sexually transmissible agents among young adults in a high-risk neighbourhood in New York City. *Addiction*. 2003; 98:159–169. [PubMed: 12534420]
- Aral SO, Hughes JP, Stoner B, et al. Sexual mixing patterns in the spread of gonococcal and chlamydial infections. *Am J Public Health*. 1999; 89:825–833. [PubMed: 10358670]
- Ellen JM, Brown BA, Chung SE, et al. Impact of sexual networks on risk for gonorrhea and chlamydia among low-income urban African American adolescents. *J Pediatr*. 2005; 146:518–522. [PubMed: 15812456]
- Lee JK, Jennings JM, Ellen JM. Discordant sexual partnering: a study of high-risk adolescents in San Francisco. *Sex Transm Dis*. 2003; 30:234–240. [PubMed: 12616143]
- Stoner BP, Whittington WL, Hughes JP, et al. Comparative epidemiology of heterosexual gonococcal and chlamydial networks: implications for transmission patterns. *Sex Transm Dis*. 2000; 27:215–223. [PubMed: 10782743]
- Garnett GP, Hughes JP, Anderson RM, et al. Sexual mixing patterns of patients attending sexually transmitted diseases clinics. *Sex Transm Dis*. 1996; 23:248–257. [PubMed: 8724517]
- Friedman SR, Bolyard M, Mateu-Gelabert P, et al. Some data-driven reflections on priorities in AIDS network research. *AIDS Behav*. 2007; 11:641–651. [PubMed: 17053857]
- Friedman SR, Bolyard M, Sandoval M, et al. Relative prevalence of different sexually transmitted infections in HIV-discordant sexual partnerships: data from a risk network study in a high-risk New York neighbourhood. *Sex Transm Infect*. 2008; 84:17–18. [PubMed: 17728340]
- McNutt LA, Wu C, Xue X, et al. Estimating the relative risk in cohort studies and clinical trials of common outcomes. *Am J Epidemiol*. 2003; 157:940–943. [PubMed: 12746247]
- Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004; 159:702–706. [PubMed: 15033648]
- Zocchetti C, Consonni D, Bertazzi PA. Estimation of prevalence rate ratios from cross-sectional data. *Int J Epidemiol*. 1995; 24:1064–1065. [PubMed: 8557441]
- Miller WC, Ford CA, Morris M, et al. Prevalence of chlamydial and gonococcal infections among young adults in the United States. *JAMA*. 2004; 291:2229–2236. [PubMed: 15138245]
- Xu F, Sternberg MR, Kottiri BJ, et al. Trends in herpes simplex virus type 1 and type 2 seroprevalence in the United States. *JAMA*. 2006; 296:964–973. [PubMed: 16926356]
- McQuillan GM, Kruszon-Moran D, Kottiri BJ, et al. Prevalence of HIV in the US household population: the National Health and Nutrition Examination Surveys, 1988 to 2002. *J Acquir Immune Defic Syndr*. 2006; 41:651–656. [PubMed: 16652040]

20. Boyer CB, Shafer MA, Teitle E, et al. Sexually transmitted diseases in a health maintenance organization teen clinic: associations of race, partner's age, and marijuana use. *Arch Pediatr Adolesc Med.* 1999; 153:838–844. [PubMed: 10437757]
21. Glynn JR, Carael M, Auvert B, et al. Why do young women have a much higher prevalence of HIV than young men? A study in Kisumu, Kenya and Ndola, Zambia. *AIDS.* 2001; 15(Suppl 4):S51–S60. [PubMed: 11686466]
22. Miller KS, Clark LF, Moore JS. Sexual initiation with older male partners and subsequent HIV risk behavior among female adolescents. *Fam Plann Perspect.* 1997; 29:212–214. [PubMed: 9323497]
23. Gregson S, Nyamukapa CA, Garnett GP, et al. Sexual mixing patterns and sex-differentials in teenage exposure to HIV infection in rural Zimbabwe. *Lancet.* 2002; 359:1896–1903. [PubMed: 12057552]
24. Pettifor AE, Rees HV, Kleinschmidt I, et al. Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. *AIDS.* 2005; 19:1525–1534. [PubMed: 16135907]
25. Begley E, Crosby RA, DiClemente RJ, et al. Older partners and STD prevalence among pregnant African American teens. *Sex Transm Dis.* 2003; 30:211–213. [PubMed: 12616137]
26. Ford K, Lepkowski JM. Characteristics of sexual partners and STD infection among American adolescents. *Int J STD AIDS.* 2004; 15:260–265. [PubMed: 15075021]
27. Stein CR, Kaufman JS, Ford CA, et al. Partner age difference and prevalence of chlamydial infection among young adult women. *Sex Transm Dis.* 2008; 35:447–452. [PubMed: 18446085]
28. Ulin PR. African women and AIDS: negotiating behavioral change. *Soc Sci Med.* 1992; 34:63–73. [PubMed: 1738858]
29. Amaro H. Love, sex, and power. Considering women's realities in HIV prevention. *Am Psychol.* 1995; 50:437–447. [PubMed: 7598292]
30. Pulerwitz J, Gortmaker SL, DeJong W. Measuring sexual relationship power in HIV/STD research. *Sex Roles.* 2000; 42:637–660.
31. deZoysa I, Sweat M, Denison J. Faithful but fearful: reducing HIV transmission in stable relationships. *AIDS.* 1996; 10:S197–S203. [PubMed: 8883630]
32. Gupta GR, Weiss E. Women's lives and sex: implications for AIDS prevention. *Cult Med Psychiatry.* 1993; 17:399–412. [PubMed: 8112084]
33. Gomez C, Marin B. Gender, culture and power: barriers to HIV prevention strategies. *J Sex Res.* 1996; 33:355–362.
34. Des Jarlais DC, Hagan H, Arasteh K, et al. Herpes simplex virus-2 and HIV among noninjecting drug users in New York city. *Sex Transm Dis.* 2007; 34:923–927. [PubMed: 18049425]
35. Maruschak, LM. HIV In Prisons, 2001. NCJ-202293. Washington, DC: Department of Justice, Bureau of Justice Statistics; 2004. p. 1-8.
36. Centers for Disease Control and Prevention. HIV/AIDS Surveillance Report, 2005. 2007; 17
37. Hammett TM. HIV/AIDS, sexually transmitted diseases, and incarceration among women: national and southern perspectives. *Sex Transm Dis.* 2006; 33:S17–S22. [PubMed: 16794551]
38. Fethers K, Marks C, Mindel A, et al. Sexually transmitted infections and risk behaviours in women who have sex with women. *Sex Transm Infect.* 2000; 76:345–349. [PubMed: 11141849]
39. Kral AH, Lorvick J, Bluthenthal RN, et al. HIV risk profile of drug-using women who have sex with women in 19 United States cities. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1997; 16:211–217. [PubMed: 9390574]
40. Friedman SR, Ompad DC, Maslow C, et al. HIV prevalence, risk behaviors, and high-risk sexual and injection networks among young women injectors who have sex with women. *Am J Public Health.* 2003; 93:902–906. [PubMed: 12773350]
41. Solarz, AL., editor. Committee on Lesbian Health Research Priorities, Neuroscience and Behavioral Health Program, Health Sciences Policy Program, Health Sciences Section. *Lesbian Health: Current Assessment and Directions for the Future.* Washington, DC: National Academy Press; 1999.
42. Marrazzo JM. Barriers to infectious disease care among lesbians. *Emerg Infect Dis.* 2004; 10:1974–1978. [PubMed: 15550210]

43. Paltiel AD, Walensky RP, Schackman BR, et al. Expanded HIV screening in the United States: effect on clinical outcomes, HIV transmission, and costs. *Ann Intern Med.* 2006; 145:797–806. [PubMed: 17146064]
44. Newman LM, Berman SM. Epidemiology of STD disparities in African American communities. *Sex Transm Dis.* 2008; 35:S4–S12. [PubMed: 18971796]
45. Wald A. Herpes simplex virus type 2 transmission: risk factors and virus shedding. *Herpes.* 2004; 11(Suppl 3):130A–137A.

TABLE 1

Characteristics of High-Risk Adults Aged 18–60 Years Involved in At Least One Sexual Partnership in the Past 3 Months (Networks, Norms, and HIV Risk Among Youth, Brooklyn, NY, 2002–2004) (N = 343 Individuals)

Participant Characteristics	N = 343	
	No. Participants	%*
Sociodemographic		
Gender		
Men	182	53.1
Women	161	46.9
Race		
Latino	239	69.7
Black	72	21.0
White	22	6.4
Other	10	2.91
Age		
18–24	120	35.0
25–29	61	17.8
30–34	39	11.4
35–39	48	14.0
40+	75	21.9
Marital status		
Single (never married)	246	71.7
Legally married	30	8.8
Informally married/living together	38	11.1
Separated	10	2.9
Divorced	10	2.9
Widowed	9	2.6
Bushwick residence		
No	68	19.8
Yes	275	80.2
Education [†]		
Grade school	21	7.7
Some high school	103	37.7
High school graduate or GED	89	32.6
Some college	28	10.3
Associate's degree	10	3.7
College graduate	2	0.7
Some graduate or professional degree	1	0.4
Graduate or professional degree	1	0.4
Employed [†]		
No	219	80.2

Participant Characteristics	N = 343	
	No. Participants	%*
Yes	54	19.8
Incarceration history		
No	187	54.5
Yes	156	45.5
Substance use		
Ever used noninjected crack		
No	170	49.6
Yes	165	48.1
Ever used noninjected cocaine		
No	103	30.0
Yes	232	67.6
Ever used noninjected heroin		
No	156	45.5
Yes	179	52.2
Ever used noninjected crack, cocaine, or heroin		
No	86	25.1
Yes	249	72.6
Ever used injection drugs		
No	214	62.4
Yes	129	37.6
Sexual behavior		
Same sex partnership		
MSM		
No	123	67.6
Yes	59	32.4
WSW		
No	92	57.1
Yes	69	42.9
Multiple partnerships in the past 3 months		
No	173	50.4
Yes	170	49.6
Lifetime number of sexual partners was greater than the median*		
No	167	48.7
Yes	176	51.3
Traded sex for drugs or money in the past year		
No	245	71.4
Yes	98	28.6
Attended a group sex event in the past year		
No	218	63.6
Yes	125	36.4

Participant Characteristics	N = 343	
	No. Participants	% *
STIs/HIV		
HSV-2 [§]		
No	165	48.1
Yes	165	48.1
HIV ^{//}		
No	287	83.7
Yes	35	10.2
Chlamydia		
No	305	88.9
Yes	21	6.1
Gonorrhea		
No	323	94.2
Yes	3	0.9
Syphilis		
No	321	93.6
Yes	11	3.2

* Percentages may not sum to 100% due to missing values and/or rounding.

[†] Among those aged 22 years and older (n = 273).

[‡] The median lifetime number of partners was 20 partners among men and 10 partners among women.

[§] The prevalence of HSV-2 differed significantly by gender and race/ethnicity (nonblack women: 56%, nonblack men: 31%, black women: 63%, black men: 67%; $P < 0.0001$).

^{//} The prevalence of HIV differed significantly by gender and race/ethnicity (nonblack women: 5%, nonblack men: 10%, black women: 15%, black men: 24%; $P = 0.016$).

TABLE 2

STI and HIV Discordance in Sexual Partnerships (Networks, Norms, and HIV Risk Among Youth, Brooklyn, NY, 2002–2004) (n = 296 Partnerships)

STI Discordance in Partnerships	No. Partnerships	%*
HSV-2		
Both partners HSV-2 negative	70	23.7
HSV-2–discordant partnership	118	39.9
Both partners HSV-2 positive	89	30.1
HIV		
Both partners HIV negative	216	73.0
HIV-discordant partnership	37	12.5
Both partners HIV positive	11	3.7
Chlamydia		
Both partners Chlamydia negative	232	78.4
Chlamydia-discordant partnership	31	10.5
Both partners Chlamydia positive	6	2.0

* Percentages may not sum to 100% due to missing values and/or rounding.

TABLE 3

Correlates of HIV-Discordant Partnerships: PRs and 95% CIs for the Associations Between Characteristics of Respondents and Their Recent Sexual Partners and Having at Least 1 HIV-Infected Partner in the Past 3 Months, Among HIV-Uninfected Adults Involved in at Least 1 Sexual Partnership in the Past 3 Months (Networks, Norms, and HIV Risk Among Youth, Brooklyn, NY, 2002–2004) (n = 287)

	% Had HIV-Infected Partner	Gender Adjusted*			
		PR	95% CI	P	
Characteristics of HIV-negative respondents in 1 partnership with an HIV-infected partner in the past 3 months					
Sociodemographic					
Gender					
Women	12.9	1	—	—	
Men	15.0	1.16	0.65 to 2.08	0.697	
Race					
Nonblack	14.4	1	—	—	
Black	12.3	0.84	0.40 to 1.75	0.644	
Age					
24	5.3	1.	—	—	
25+	19.5	3.66	1.57 to 8.52	0.003	
Lives outside of Bushwick					
No	15.7	1.	—	—	
Yes	6.9	0.44	0.16 to 1.19	0.105	
High school graduation [†]					
Yes	14.3	1	—	—	
No	21.0	1.47	0.80 to 2.71	0.217	
Current employment [‡]					
Yes	7.0	1	—	—	
No	19.6	2.88	0.92 to 9.07	0.070	
Incarceration history					
No	9.9	1.	—	—	
Yes	19.2	2.03	1.06 to 3.92	0.034	
Substance use					
Ever used noninjected crack					
No	7.9	1	—	—	
Yes	19.2	2.43	1.27 to 4.65	0.007	
Ever used noninjected cocaine					
No	5.4	1	—	—	
Yes	16.9	3.14	1.27 to 7.75	0.013	
Ever used noninjected heroin					
No	5.0	1	—	—	
Yes	21.3	4.38	2.03 to 9.45	<0.001	
Ever used injection drugs					

	% Had HIV-Infected Partner	Gender Adjusted*		
		PR	95% CI	P
No	8.7	1	—	—
Yes	23.3	2.69	1.49 to 4.86	0.001
Sexual behavior				
Same sex partnership history				
MSM				
No	11.8	1	—	—
Yes	24.3	2.06	0.96 to 4.42	0.065
WSW				
No	13.8	1	—	—
Yes	11.7	0.85	0.35 to 2.06	0.717
Multiple partnership in the past 3 months				
No	13.0	1	—	—
Yes	14.9	1.14	0.64 to 2.03	0.655
High lifetime number of sexual partners (greater than the median) [‡]				
No	13.7	1	—	—
Yes	14.2	1.07	0.61 to 1.86	0.819
		Men: 0.56	0.23 to 1.35	0.196
		Women: 2.48	0.86 to 7.15	0.094
Exchanged sex for drugs or money in the past year				
No	12.9	1	—	—
Yes	16.9	1.33	0.72 to 2.45	0.357
Attended a group sex event in the past year				
No	13.4	1	—	—
Yes	15.0	1.09	0.60 to 1.98	0.776
Sexual partner characteristics: HIV-2–negative respondent 1 sexual partner in the past 3 months who...				
Sociodemographic				
Was 25 years or older				
No	1.3	1	—	—
Yes	18.6	9.89 [§]	1.16 to 84.3	0.036
Had a partner who was >5 years older				
No	9.2	1	—	—
Yes	22.6	2.54 [§]	1.42 to 4.55	0.002
Was from outside Bushwick				
No	15.0	1	—	—
Yes	11.5	0.76	0.39 to 1.47	0.413
Did not graduate from high school				
No	8.4	1	—	—
Yes	17.2	2.03	1.00 to 4.12	0.051
Was currently unemployed				

	% Had HIV-Infected Partner	Gender Adjusted*		
		PR	95% CI	P
No	2.8	1	—	—
Yes	15.5	5.52	0.79 to 38.7	0.086
Had an incarceration history				
No	8.3	1	—	—
Yes	17.4	2.03	1.00 to 4.12	0.029
Substance use				
Ever used noninjected crack, cocaine, or heroin				
No	3.5	1	—	—
Yes	16.6	4.83	1.19 to 19.7	0.028
Ever used injection drugs				
No	3.6	1.	—	—
Yes	23.7	6.63	2.66 to 16.5	<0.001
Sexual behavior				
Was a MSM				
No	6.5	1	—	—
Yes	36.6	5.64	3.12 to 10.2	<0.001
Was a WSW				
No	11.0	1	—	—
Yes	19.8	1.81	1.00 to 3.29	0.049
Had multiple partnerships in the past 3 months				
No	8.3	1	—	—
Yes	16.3	1.94	0.89 to 4.23	0.097
Had a high lifetime number of sexual partners (greater than the median) [‡]				
No	5.1	1	—	—
Yes	18.6	3.68	1.48 to 9.12	0.005

* Gender-adjusted PRs and 95% CI were estimated. In cases where associations differed significantly by gender, as indicated by significance of the gender by exposure product interaction term ($P < 0.15$), gender-specific associations were also presented.

[†] Among those aged 22 years and older.

[‡] The median lifetime number of partners was 20 partners among men and 10 partners among women.

[§] The association was adjusted for respondent age (25 years and older versus younger than 25 years).

MSM, man who ever had sex with a man; WSW, woman who ever had sex with a woman.

TABLE 4

Correlates of HSV-2–Discordant Partnerships: PRs and 95% CIs for the Associations Between Characteristics of Respondents and Their Recent Sexual Partners and Having at Least 1 HSV-2–Infected Partner in the Past 3 Months, Among HSV-2–Uninfected Adults Involved in at Least 1 Sexual Partnership in the Past 3 Months (Networks, Norms, and HIV Risk Among Youth, Brooklyn, NY, 2002–2004) (n = 165)

	% Had HSV-2– Infected Partner	Gender Adjusted*			
		PR	95% CI	P	
Characteristics of HSV-2 negative respondents in 1 partnership with an HSV-2–infected partner in the past 3 months					
Sociodemographic					
Gender					
Women	44.6	1	—	—	
Men	63.0	1.41	1.03 to 1.93	0.029	
Race					
Nonblack	54.8	1	—	—	
Black	60.0	1.08	0.7 to 1.51	0.637	
Age					
24	44.6	1	—	—	
25+	67.1	1.43	1.08 to 1.91	0.014	
Lives outside of Bushwick					
No	55.2	1	—	—	
Yes	58.6	1.09	0.78 to 1.51	0.618	
High school graduation [†]					
Yes	64.3	1	—	—	
No	61.7	0.96	0.71 to 1.30	0.800	
Current employment [‡]					
Yes	60.7	1	—	—	
No	63.9	1.11	0.7 to 1.55	0.555	
Incarceration history					
No	48.1	1	—	—	
Yes	69.5	1.31	0.98 to 1.75	0.065	
		Men: 1.11	0.82 to 1.50	0.509	
		Women: 2.57	1.86 to 3.53	<0.001	
Substance use					
Ever used noninjected crack					
No	44.4	1	—	—	
Yes	72.1	1.55	1.17 to 2.04	0.002	
Ever used noninjected cocaine					
No	43.1	1	—	—	
Yes	63.2	1.40	1.02 to 1.93	0.039	
Ever used noninjected heroin					
No	43.2	1	—	—	

	% Had HSV-2- Infected Partner	Gender Adjusted*		
		PR	95% CI	P
Yes	72.3	1.59	1.18 to 2.13	0.002
Ever used injection drugs				
No	45.5	1	—	—
Yes	76.4	1.47	1.13 to 1.90	0.004
Sexual behavior				
Same sex partnership history				
MSM				
No	60.5	1	—	—
Yes	70.8	1.17	0.85 to 1.61	0.329
WSW				
No	32.5	1	—	—
Yes	64.0	1.97	1.15 to 3.38	0.014
Multiple partnership in the past 3 months				
No	45.1	1	—	—
Yes	68.9	1.46	1.11 to 1.92	0.007
		Men: 1.23	0.90 to 1.68	0.188
		Women: 2.09	1.25 to 3.51	0.005
High lifetime number of sexual partners (greater than the median) [‡]				
No	44.8	1	—	—
Yes	71.0	1.60	1.23 to 2.08	0.001
Exchanged sex for drugs or money in past year				
No	49.6	1	—	—
Yes	76.3	1.49	1.16 to 1.91	0.002
Attended a group sex event in the past year				
No	46.2	1	—	—
Yes	72.9	1.49	1.14 to 1.94	0.003
Sexual partner characteristics: HSV-2 negative respondent had 1 sexual partner in the past 3 months who...				
Sociodemographic				
Was 25 years or older				
No	32.8	1	—	—
Yes	69.2	2.02 [§]	1.34 to 3.05	0.001
Had a partner who was >5 years older				
No	46.8	1	—	—
Yes	73.2	1.44 [§]	1.24 to 1.67	<0.001
		Men: 1.40 [§]	1.05 to 1.85	0.020
		Women: 2.22 [§]	1.26 to 3.92	0.006
Was from outside Bushwick				
No	48.3	1	—	—
Yes	74.5	1.51	1.18 to 1.93	0.001

	% Had HSV-2-Infected Partner	Gender Adjusted*		
		PR	95% CI	P
Did not graduate from high school				
No	40.0	1	—	—
Yes	64.8	1.58	1.12 to 2.22	0.009
Was currently unemployed				
No	36.0	1	—	—
Yes	59.3	1.48	0.86 to 2.55	0.155
		Men: 0.87	0.53 to 1.43	0.592
		Women: 2.39	0.97 to 5.93	0.059
Had an incarceration history				
No	38.9	1	—	—
Yes	68.8	1.87	1.37 to 2.55	<0.001
Substance use				
Ever used noninjected crack, cocaine, or heroin				
No	25.6	1	—	—
Yes	65.1	2.47	1.42 to 4.31	0.001
Ever used injection drugs				
No	42.9	1	—	—
Yes	71.6	1.61	1.22 to 2.13	0.001
Sexual behavior				
Was a MSM				
No	52.8	1	—	—
Yes	65.8	1.23	0.94 to 1.63	0.136
Was a WSW				
No	44.3	1	—	—
Yes	76.3	1.64	1.26 to 2.13	<0.001
Had multiple partnerships in the past 3 months				
No	35.6	1	—	—
Yes	66.4	1.87	1.27 to 2.75	0.001
Had a high lifetime number of sexual partners (greater than the median) [‡]				
No	30.3	1	—	—
Yes	72.7	2.31	1.56 to 3.41	<0.001
		Men: 3.09	1.68 to 5.69	<0.001
		Women: 1.65	0.95 to 2.88	0.077

* Gender-adjusted PRs and 95% CI were estimated. In cases where associations differed significantly by gender, as indicated by significance of the gender by exposure product interaction term ($P < 0.15$), gender-specific associations were also presented.

[†] Among those aged 22 years and older.

[‡] The median lifetime number of partners was 20 partners among men and 10 partners among women.

[§] The association was adjusted for respondent age (25 years and older versus younger than 25 years).

MSM, man who ever had sex with a man; WSW, woman who ever had sex with a woman.

TABLE 5

Correlates of Chlamydia-Discordant Partnerships: PRs and 95% CIs for the Associations Between Characteristics of Respondents and Their Recent Sexual Partners and Having at Least 1 Partner With Chlamydial Infection in the Past 3 Months, Among Adults Without Chlamydial Infection Involved in at Least 1 Sexual Partnership in the Past 3 Months (Networks, Norms, and HIV Risk Among Youth, Brooklyn, NY, 2002–2004) (n = 305)

	% Had Chlamydia-Infected Partner	Gender Adjusted*			
		PR	95% CI	P	
Characteristics of Chlamydia-negative respondents in 1 partnership with a Chlamydia-infected partner in the past 3 months					
Sociodemographic					
Gender					
Women	11.0	1	—	—	
Men	13.8	1.25	0.68 to 2.28	0.476	
Race					
Nonblack	9.7	1	—	—	
Black	20.3	2.05	1.12 to 3.72	0.019	
Age					
24	15.4	1	—	—	
25+	11.0	0.69	0.38 to 1.27	0.234	
Lives outside of Bushwick					
No	12.7	1	—	—	
Yes	11.7	0.92	0.42 to 1.98	0.823	
High school graduation [†]					
Yes	8.4	1	—	—	
No	15.5	1.51	0.80 to 2.88	0.203	
Current employment [‡]					
Yes	4.1	1	—	—	
No	13.3	2.19	0.80 to 5.94	0.125	
Incarceration history					
No	14.7	1	—	—	
Yes	9.6	0.58	0.29 to 1.17	0.128	
		Men: 0.39	0.17 to 0.88	0.023	
		Women: 1.19	0.44 to 3.22	0.728	
Substance use					
Ever used noninjected crack					
No	9.8	1	—	—	
Yes	14.4	1.47	0.79 to 2.73	0.227	
Ever used noninjected cocaine					
No	11.3	1	—	—	
Yes	12.4	1.07	0.55 to 2.10	0.830	
Ever used noninjected heroin					

	% Had Chlamydia-Infected Partner	Gender Adjusted*		
		PR	95% CI	P
No	11.5	1	—	—
Yes	12.5	1.05	0.55 to 2.00	0.880
		Men: 0.71	0.32 to 1.57	0.400
		Women: 1.80	0.68 to 4.81	0.238
Ever used injection drugs				
No	11.9	1	—	—
Yes	13.5	1.11	0.60 to 2.08	0.733
Sexual behavior				
Same sex partnership history				
MSM				
No	11.1	1	—	—
Yes	19.2	1.73	0.80 to 3.75	0.165
WSW				
No	3.5	1	—	—
Yes	22.4	6.50	1.93 to 21.9	0.003
Multiple partnership in the past 3 months				
No	6.9	1	—	—
Yes	18.5	2.65	1.36 to 5.18	0.004
		Men: 1.75	0.78 to 3.95	0.177
		Women: 5.19	1.54 to 17.5	0.008
High lifetime number of sexual partners (greater than the median) [‡]				
No	9.3	1	—	—
Yes	15.6	1.75	0.95 to 3.22	0.072
Exchanged sex for drugs or money in past year				
No	8.0	1	—	—
Yes	24.7	3.11	1.74 to 5.54	<0.001
		Men: 1.71	0.78 to 3.79	0.183
		Women: 7.61	2.60 to 22.3	<0.001
Attended a group sex event in the past year				
No	9.1	1	—	—
Yes	18.7	2.03	1.06 to 3.86	0.032
Sexual partner characteristics: Chlamydia-negative respondent had 1 sexual partner in the past 3 months who...				
Sociodemographic				
Was 25 years or older				
No	10.8	1	—	—
Yes	13.0	1.73 [§]	0.77 to 3.90	0.186
Had a partner who was >5 years older				
No	9.7	1	—	—
Yes	17.3	1.87 [§]	1.02 to 3.44	0.044

	% Had Chlamydia-Infected Partner	Gender Adjusted*		
		PR	95% CI	P
Was from outside Bushwick				
No	9.3	1	—	—
Yes	20.0	2.14	1.19 to 3.86	0.011
Did not graduate from high school				
No	7.0	1	—	—
Yes	15.8	2.23	1.03 to 4.78	0.040
Was currently unemployed				
No	11.1	1	—	—
Yes	12.6	1.08	0.40 to 2.93	0.882
Had an incarceration history				
No	8.0	1	—	—
Yes	15.1	2.01	0.97 to 4.13	0.059
Substance use				
Ever used noninjected crack, cocaine, or heroin				
No	5.2	1	—	—
Yes	14.2	2.76	0.88 to 8.67	0.082
Ever used injection drugs				
No	8.3	1	—	—
Yes	16.3	1.98	1.03 to 3.78	0.040
Sexual behavior				
Was a MSM				
No	8.7	1	—	—
Yes	26.7	3.10	1.72 to 5.59	<0.001
Was a WSW				
No	5.0	1	—	—
Yes	41.7	4.14	2.06 to 8.32	<0.001
		Men: 2.25	1.00 to 5.07	0.050
		Women: 8.40	3.37 to 21.0	<0.001
Had multiple partnerships in the past 3 months				
No	1.0	1	—	—
Yes	17.9	17.4	2.42 to 126	0.005
Had a high lifetime number of sexual partners (greater than the median) [‡]				
No	2.7	1	—	—
Yes	18.0	6.53	2.02 to 21.1	0.002

* Gender-adjusted PRs and 95% CI were estimated. In cases where associations differed significantly by gender, as indicated by significance of the gender by exposure product interaction term ($P < 0.15$), gender-specific associations were also presented.

[†] Among those aged 22 years and older.

[‡] The median lifetime number of partners was 20 partners among men and 10 partners among women.

[§] The association was adjusted for respondent age (25 years and older versus younger than 25 years).

MSM, man who ever had sex with a man; WSW, woman who ever had sex with a woman.

TABLE 6

Detection of Priority Populations for HIV and HSV-2* Testing Using a Screening Tool Composed of Sexual Risk and Injection Drug Indicators Alone Versus Sexual Risk and Injection Drug Indicators Plus Indicators of Older Age, Non-IDU, and Incarceration[†] (Networks, Norms, and HIV Risk Among Youth, Brooklyn, NY, 2002–2004) (n = 186)[‡]

Screening Tools	Screening for HIV Priority Populations			Screening for of HSV-2 Priority Populations		
	Sensitivity (%)	Specificity (%)	Prevalence of Population Identified for HIV Testing (%)	Sensitivity (%)	Specificity (%)	Prevalence of Population Identified for HSV-2 Testing (%)
"CDC Screener" (based on sexual risk and IDU exposure indicators only) [§]	57	53	48	53	66	47
"CDC screener" plus indicator of respondent age 25 years	95	32	71	81	50	71
"CDC screener" plus indicators of respondent Age 25 years and recent sex with a partner who was 25 years	100	27	75	85	45	76
"CDC screener" plus indicator of respondent age 25 years, recent sex with a partner who was 25 years, respondent incarceration history, and respondent non-IDU history	100	18	84	90	30	84

* We defined priority populations for HIV testing as individuals who were HIV infected or who had sex in the past 3 months with an HIV-infected partner and priority populations for HSV-2 testing as individuals who were infected with HSV-2 or who had sex in the past 3 months with a partner who was infected with HSV-2.

[†]The sensitivity and specificity of each screening tool for identification of HIV or HSV-2 priority populations were calculated compared with the gold standard, the actual size of the priority populations determined by HIV and HSV-2 testing during the study. For HIV screening, the number of individuals identified by the screening tool was compared with the number of individuals with biologically confirmed HIV infection and/or who had a sex partner in the past 3 months with biologically confirmed HIV infection. For HSV-2 screening, the number of individuals identified by the screening tool was compared with the number of individuals with biologically confirmed HIV infection and/or who had a sex partner in the past 3 months with biologically confirmed HIV infection.

[‡]The analytic sample excluded IDUs and men who have had sex with at least 1 male sex partner (MSM). Because IDU and MSM populations are already routinely identified as high-risk populations for STI/HIV screening, we wished to assess the performance of the screening tools in additional risk populations.

[§]The "CDC Screener" was based on the CDC indicators of high-risk populations we measured in the NNAHRY questionnaire, excluding history of IDU and MSM. The indicators included: respondent perception that a sex partner had an IDU history, respondent report of exchange of sex for drugs or money in the past year, and respondent history of multiple partnerships in the past 3 months. (Respondent perception of whether a recent sex partner had multiple sexual partners, a CDC-recommended indicator of high-risk populations, was not assessed during NNAHRY and hence was not included in the "CDC Screener".)