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Prevalence of Bacterial Sexually Transmitted Infections and Pre-Exposure Prophylaxis Eligibility in a Cross-Sectional Sample of HIV Negative Men who have Sex with Men in Atlanta Georgia

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B.A., Emory University, 2012

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Abstract

Prevalence of Bacterial Sexually Transmitted Infections and Pre-Exposure Prophylaxis Eligibility in a Cross-Sectional Sample of HIV Negative Men who have Sex with Men in Atlanta Georgia

By Loretta Foster

Objectives: To determine any predictors of bacterial sexually transmitted infections (STIs) among men who have sex with men (MSM) in Atlanta GA and to determine if CDC PrEP eligibility correlates to positive STI diagnosis.

Methods: A subgroup of HIV negative non-Hispanic white and black MSM was gathered from the InvolveMENt and The MAN Project studies. Participants completed a computer based questionnaire with questions about demographic, psychosocial, individual level sexual risk behaviors, and dyadic information. Men were also screened for chlamydia, gonorrhea, and syphilis.

Results: 265 participants were selected for analysis. Racial composition was 57.0% black and 43.0% white. 33 (12.5%) participants were diagnosed with at least one STI. Prevalence of chlamydia was 8.7%, gonorrhea 6.0%, and syphilis 1.5%. Multiple infection prevalence was 3.8% with 90% of co-infections chlamydia and gonorrhea, and 10% chlamydia and syphilis. Rectal infections were more common than urethral infections Predictors of a positive STI diagnosis were black race, lower education, and lack of health insurance. CDC PrEP eligibility guidelines were not associated with STI diagnosis.

Conclusion: Atlanta MSM exhibit high prevalence of bacterial STIs with respect to racial and educational divisions. CDC PrEP eligibility guidelines do not fit this population and should be altered to better predict individuals who are engaging in high risk behaviors and acquiring bacterial STIs.

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Background

In the United States, significant inequalities exist between races, gender, and sexual orientation regarding the burden of sexually transmitted infections (STIs). The group most effected by STIs are men who have sex with men (MSM) who are the largest group at risk across the country. As of 2013, MSM were the most represented category of infected individuals, representing 68% of new infections compared to 25% of infections in the heterosexual population (1). Additionally MSM are the only sexual orientation category that saw growth in the number of HIV infections between 2009 and 2013 (1). Race is also a factor in the disparity with Black MSM being at an even greater risk than their white counterparts. Between 1999 and 2008 Black MSM in San Francisco consistently had the highest rate of infection in both gonorrhea and chlamydia (2). The same trend is seen in Atlanta where black MSM reported gonorrhea and chlamydia prevalence 3 to 4 times higher than white MSM (3).

The STD Surveillance Network (SSuN) conducted by the Centers for Disease Control (CDC) found that MSM had proportionally more cases of gonorrhea for all age groups expect for those under 19 years old and chlamydia for ages over 25 years old compared to heterosexual men and women (4). For MSM STI infection is a marker for risky sexual behavior. Multiple studies have shown that gonorrhea and chlamydia are often found in conjunction with a new HIV infection (5, 6). Additionally syphilis and HIV co-infection is high in the population ranging from 20 to 70 percent of those with syphilis also having HIV (7). Positive STI tests can be useful in objectively determining risky behavior even

when interview data is available. Respondents often face recall bias, social desirability bias, embarrassment, and more. When patients who did not keep an accurate log of sexual activity were asked to remember the number of encounters over the past 6 months 52% reported fewer incidents than when a log was kept (8).

STIs are not only a marker for risky behavior; infection serves to increase HIV infectiousness and susceptibility in the population. Studies have found that STIs increase risk of HIV acquisition between 2 to 23.5 times, though most cluster around 2 to 5 times (9). Even in individuals where HIV infection is already present an active STI can increase the viral load in the individual and increase infectiousness (10, 11). There is evidence that MSM are becoming more aware of HIV status of partners and take risk reduction measures to reduce transmission of HIV by changing the type of sex, insertive or receptive based upon knowledge of a partner's status (12). Though MSM are taking steps to reduce HIV, the same strategy is not as effective in preventing new STIs where infection can be asymptomatic. Studies have found between 14 – 16% prevalence of asymptomatic infections in MSM (13, 14).

MSM who test positive for one or more STIs are engaging in activities, both sexual and social, that put them at an increased risk for HIV infection. MSM who are depressed, use drugs or alcohol, or experience violence are more likely than others in the same group to contract an STI or HIV (15, 16). Syndemic theory was first used to describe the associations between violence, substance abuse and AIDS in a population of urban poor (17). Subsequent research into

syndemic theory found that the greater the number of psychosocial problems such as polydrug use, violence, sexual abuse, mental health issues, etc, the higher rates of HIV infection and reports of unprotected anal intercourse (UAI) (18).

Race is also a factor in STI and HIV infection in the MSM population. Black MSM report higher rates of infection for gonorrhea, chlamydia, syphilis, and HIV compared to any other ethnic, racial, or sexual orientation group (1, 3, 4, 7). The racial disparity in HIV and STI prevalence exists across the country (2, 19). In Atlanta black MSM are more likely to live in areas of high poverty and high stigma against identifying as gay (19). Additionally, in Georgia, blacks comprise the majority of cases of chlamydia, gonorrhea, and syphilis, and approximately 60% of HIV positive MSM (4, 20). For black MSM in Atlanta, the underlying prevalence of STIs and HIV are greater than for white MSM to such an extent that black MSM are more likely to contract HIV for each individual UAI encounter than white MSM (21, 22).

The combination of psychosocial behaviors and race negatively impact the risk black MSM have to contract an STI or HIV. Black MSM are more likely to perceive stigma in their environment resulting in reduced disclosure of sexual orientation, internalized homophobia, increased perception of disapproval from peers, and identifying as heterosexual more often (19, 23). The perceived stigma felt by black MSM may lead to reduction in care seeking behaviors, and when placed into a context where black MSM are more likely to reside in areas of high poverty without access to the same medical care as white MSM, the risk of acquiring an STI or HIV increase (1, 3, 19, 24).

Pre-Exposure Prophylaxis (PrEP) is a method for HIV negative men to reduce their risk of contracting HIV by taking the HIV medication Truvada© (25). Previous studies have found the PrEP can reduce the risk of acquiring HIV by 75-92% (26, 27). Since the cost of PrEP can be high, as much as $9762 per person annually, recent studies and reports aim to identify the most at risk groups who would be best served by starting PrEP (28). High risk MSM, such as young black MSM, are the most cost-effective group to provide PrEP (28). Due to the success of PrEP, the Centers for Disease Control (CDC) created a clinical practice guideline for providers interested in utilizing PrEP (29). CDC created two provider guidelines for determining if a patient is at high risk of acquiring HIV (29) [Appendix A]. The existence of multiple criteria to determine if a patient is high risk is often times confusing for clinicians who may be interested in provide PrEP to patients (30). Despite CDC releasing at least two articles with interim guidance on PrEP for clinicians, when providers were questioned about characteristics of a high risk patient, variability existed between physicians (31-33).

This analysis will seek to characterize the prevalence of chlamydia, gonorrhea, and syphilis, and multiple infections of STIs in an HIV negative pool of participants from InvolveMENt and The MAN Project participants. Effort will be made to determine predictors associated with increased risk of infection in order to determine if a certain segment of the participants is at greater risk of acquiring an STI. Prevalence of multiple infections of bacterial STIs will be determined as well as any predictors that may be associated with infection.

Additionally the CDC guideline A1 will be compared to the population to determine if the suggested clinician risk behavior questionnaire identifies the group with an objective risk for HIV, those with at least one STI (34)[Appendix A]. The overall eligibility for PrEP as well as the individual compnents of eligibility will be compared to the participants to determine if PrEP suitability differs between those with at least one prevalent STI and those without.

Methods

Data were gathered from two distinct studies conducted contemporaneously in Atlanta, GA: The Men's Atlanta Networks (MAN) Project and InvolveMENt. Both studies were community based prospective cohort studies that recruited MSM from the Atlanta Metropolitan Area. The studies limited the race of the participants to black and white non-Hispanic and men aged between 18 and 40 years. For InvolveMENt participants were recruited through venue-sampling. Random sampling was to select venues in which MSM in Atlanta tended to congregate, such as bars, dance clubs, fitness clubs, Gay Pride events, parks, restaurants, and more. Virtual venue-sampling utilized Facebook banner advertisements targeted at men 18 or over, who listed their location as Atlanta, and specified an interest in men. Recruitment for the InvolveMENt project occurred between June 2010 and December 2012. The MAN Project utilized the same physical venue-sampling, but did not utilize virtual venue-sampling, instead employing chain referral sampling whereby one participant could refer up to three recent male sex partners. Recent partner was defined as men with whom the initial participant had sex in the previous 12 months. Recruitment for The MAN Project occurred between April 2011 and March 2013.

Eligibility criteria for InvolveMENt included being a male at birth, black or white race only, currently living the Atlanta Metropolitan Statistical Area with no intention of leaving the area for at least 2 years, ability to communicate in English, at least 1 male sex partner in the previous 3 months, not in a

monogamous relationship at enrollment, and not part of another HIV prevention study. Initially any males over the age of 18 were eligible, but after 3 months of enrollment the age range was changed to men 18 to 40 years to better capture the population with the highest risk of HIV infection. After screening for eligibility 454 black MSM and 349 white MSM agreed to participate in InvolveMENt. Eligibility criteria for The MAN Project included residence in the Atlanta Metropolitan Area, sex with a man in the previous 3 months prior to survey, non-Hispanic Black or White, and aged 18 to 40 years old. Participants gathered through chain referral sampling were eligible if they were over 18 years old, lived in the Atlanta Metropolitan Area, and had sex with the participant who referred them. Race was not a condition of chain sampling to accurately reflect the sexual networks of black and white MSM in Atlanta. The MAN Project recruited 87 black MSM and 55 white MSM seed participants, with an additional 114 partner participants.

Both InvolveMENt and The MAN Project utilized self-administered computer questionnaires to capture participant responses. The questionnaire for InvolveMENt employed content modified from the first cycle of the National HIV Behavioral Surveillance Sytems (NHBS) from 2003 to 2005. Questions included demographics, psychosocial scales, community characteristics, individual level HIV related behaviors, and dyadic information on up to 5 partners in the previous 6 months. The MAN Project questionnaire also gathered information on demographics and individual level HIV related behaviors, but gathered dyadic information for up to 10 sexual partners from the previous 12 months.

Biomedical measures were collected for Gonorrhea, Chlamydia, and Syphilis. Participants were tested for urethral *Neisseria gonorrhea*, and *Chlamydia trachomatis*, and rectal testing for these pathogens was performed on self-collected rectal swabs. Testing for Gonorrhea and Chlamydia was by the Becton Dickinson ProbeTec ET *C. trachomatis* and *N.* gonorrhea Amplified DNA Assay. Syphilis testing was conducted using a rapid plasma reagent (RPR) test and for specimens which were reactive to the RPR test additional titers were completed. Active syphilis was determined by experienced clinicians using a combination of recent and previous RPR, titer results, and patient treatment history. All participants who tested positive for an STI were notified and referred to a community treatment provider.

Restriction on testing at both urethral and rectal sites was a necessity to determine if co-infection or multiple infections were present in the population. This limited the available pool of participants from the studies since both InvolveMENt and The MAN Project originally tested only for urethral infection and did not begin testing for rectal infections until later in the study. A subset of 265 participants was gathered from the InvolveMENt study and The MAN Project. Inclusion in the analysis required that the participant test negative for HIV and have results of STI testing from both urethral and rectal sites. Restriction on HIV negative status was chosen to focus on individuals with at least one STI without the additional medical complications that accompany HIV infection. Additionally, STI infection was used as an objective indicator for HIV risk to compare to CDC PrEP guidelines and determine who would benefit from

starting pre-exposure prophylaxis (PrEP), which requires the patient be HIV negative.

Predictors chosen for the analysis included: age, education, income, health insurance status, incarceration, employment, multiple drugs, number of partners, casual partners, UAI, and STI diagnosis. All responses used in the analysis were chosen from a set of predefined choices, with the exception of age and partner questions which were recorded as a continuous variable. Several predictors applied to a 6 or 12 month recall period. Survey questions for HIV test, incarceration, employment, and housing status were dichotomous. Possible responses for circumcision included an unsure response, and insurance status included a response to allow participants to refuse to disclose. Education was divided into three categories progressing from high school graduate or less education to college. The original survey included four categories, but the cell count for less than high school was very low with only six responses. Income level had a series of 5 ordinal responses, each equally spaced from less than $20,000 to more than $50,000. The InvolveMENt and The MAN Project questionnaires allowed for multiple categories of drug use, such as once per day, more than once per day, once per week, more than once per week, once per month, more than once per month, less than once per month, for individual drugs. The categories were reduced to any drug use and no drug use for each of these individual drugs in order to increase cell counts since data was sparse. Dyadic measures were measured with continuous data, but were classified into 3 categories for the analysis. The categories chosen were 0-2 partners, 3-5 partners,

and 6+ partners. These categories were chosen based on previous literature regarding partner counts and tertile cut points from the sample data (8, 13, 21).

Bivariate analyses were conducted on chosen demographic, sexual behavior, and self-reported drug use for those with at least one prevalent STI and those without an STI. Prevalence, prevalence odds ratios, 95% confidence intervals, and chi-square p-values were calculated for all categorical variables. All analyses utilized exact confidence intervals and were calculated with SAS 9.3.

To compare the results to PrEP eligibility each question that comprised the recommended guidelines for the provider were separated into distinct scores [Appendix B]. Once the scores were tabulated for each individual component of the guidelines an overall score was calculated to be compared to participants who tested positive for an STI. PrEP eligibility was defined as a score of more than 10 points based on the scoring algorithm [Appendix B]. For overall PrEP eligibility as well as each component variable the percentage of participants who would receive PrEP were calculated. The percentages were then compared and chi square p-values calculated utilizing SAS 9.3.

Results

After applying selection criteria to the participants from the MAN Project and InvolveMENt a subset of 265 participants was created. STI diagnoses revealed that 12.5% (33/265) of the participants were diagnosed with at least 1 prevalent STI. Demographic results indicated that the median age of participants was 26 years, with a minimum age of 18 and a maximum age of 39. Mean age was 26.9 years with a similar median age. The race breakdown of the participants was 57.0% reporting non-Hispanic black and 43.0% reporting non-Hispanic white. Overall the participants were well educated with 37.7% reporting some college education and 44.5% college graduation. The majority of respondents were employed (78.1%), not homeless (89.9%), had some form of health insurance (65.7%), were circumcised (78.1%), and identified as homosexual (83.8%). Most respondents did not report drug use (65.5%). Injection drug use was very uncommon with only 0.8% reporting use. The most common drug reported was marijuana with 80 of the 265 (30.2%) respondents reporting some use in the past month. Results for the sexual behavior of participants showed that 33.1% reported 0 to 2 male partners in 6 months, but that over a 12 month period, only 14.8% reported the same. Over a 12 month period nearly half (48.7%) of participants reported 6 or more partners. The majority of participants reported few anal intercourse partners or unprotected anal intercourse partners in the previous 6 months, 56.9% and 84.4% respectively. The number of main male partners in the previous 12 months was also low, 0 to 2 partners for 81.4% of respondents. [Table 1].

Bivariate analysis of those with at least 1 prevalent STI compared to those without an STI indicate that race, education, and health insurance were statistically significantly related to STI diagnosis. STI diagnoses differed significantly by race with overall STI prevalence of 21.8% for blacks and 5.6% for whites, an odds ratio of 3.92 (95% CI: 1.56 – 9.85) and a chi-square p-value of 0.0021. Increased education was associated with a reduced prevalence of STI in the observations. Within education only the difference between less than high school / high school graduate and college education demonstrated a statistically significant reduction in STI odds with a prevalence odds ratio of 0.25 (95% CI: 0.09 – 0.73, p-value 0.0070). The difference between less than high school / high school graduate and some college education was not significant. The odds of at least one STI for those who had health insurance was statistically significantly lower than for those without health insurance by 2.14 times (95% CI: 1.02 – 4.48, p-value 0.0402). [Table 2].

Of the STI diagnoses, Chlamydia was most common with 23 (23/265 8.7%) diagnoses, followed by gonorrhea at 16 cases (16/265 6.0%) and syphilis with 4 cases (4/265 1.5%). Multiple infections were noted in 10 participants (10/265 3.8%). Rectal infections were the most common with 33 (12.5%) positive diagnoses. Urethral infections were second with 2.3% (6 cases), and only 2 participants were diagnosed with chlamydia in both the rectum and urethra. Infection with both chlamydia and gonorrhea was most common, representing 9 of the 10 instances of multiple infection with one additional case co-infection of rectal chlamydia and syphilis. Of the 9 cases of co-infection with chlamydia and

gonorrhea, 8 of the diagnoses were both located in the rectum, while 1 participant was diagnosed with rectal chlamydia and urethral gonorrhea. Blacks were the majority of chlamydia (82.6%), gonorrhea (93.8%), and multiple infection (90.0%) cases. Race was not associated with syphilis infection due to even diagnoses between black and white. Participants aged 20-24 represented at least 50% of diagnoses for each STI: 56.5% of chlamydia, 50.0% of gonorrhea and syphilis, and 60.0% of multiple infection diagnoses. For education at least 50% of diagnoses for each STI were found in individuals with some college education. Gonorrhea was different from chlamydia, syphilis, and multiple infections with the second most represented education level of college graduate instead of less than high school education / high school graduate which was second for the other STIs. For all STIs the majority of individuals were employed, not homeless, circumcised, and did not use any drugs. The majority of participants with chlamydia and multiple infections were non-insured individuals, 52.2% and 60% respectively, whereas gonorrhea and syphilis had equal proportions of infected in insured and non-insured [Table 3].

Regarding sexual behavior for STIs, most of the participants reported between 3 and 5 partners in the previous 6 months. Gonorrhea was an exception with the largest percentage of those infected reporting 6 or more partners in the last 6 months (43.8%). The number of UAI partners in the previous 6 months was reported to be low. For all bacterial infections and multiple infections 0 to 2 partners was the most common, ranging from 50.0% of syphilis cases to 82.6% of chlamydia infections. The number of casual partners does not appear to follow a

pattern between infections. For chlamydia the percentage of participants reporting in the three categories of partners is approximately even, while in gonorrhea cases, 0 to 2 partners and 6 or more partners are 43.8% and 50.0% of the cases with only 6.3% reporting 3 to 5 partners. [Table 3].

When STI status was compared to PrEP criteria there were no statistically significant associations observed in the data. Thus, the likelihood of being PrEP eligible utilizing the box A1 criteria developed by CDC was not associated with testing positive for an STI. These results indicate that the percentage of individuals who test positive for at least 1 prevalent STI and receive PrEP is not different from the percentage of participants who do not test positive and receive PrEP (p-value: 0.8162). The similarity between the percentage of individuals who have at least 1 prevalent STI and who are PrEP eligible and those who do not have an STI and are PrEP eligible continue for all questions which comprise the CDC guidelines. [Table 4].

Discussion

This analysis sought to find predictors of at least one prevalent STI and those with multiple STIs in a population of Atlanta black and white MSM, as well as determine if the CDC guidelines for PrEP eligibility were well suited to this demographic. Due to the high number of STI and HIV cases in the South, determining the correct group at high risk for STIs and HIV will aid in determining which individuals would be best suited to beginning the effective, but expensive, PrEP (4, 28, 30). The population assessed was non-Hispanic black and white MSM gathered from the InvolveMENt study and The MAN Project. All men were HIV negative in order to determine which group would be a highest risk of acquiring HIV and would be suited to begin PrEP.

Demographic characteristics of the InvolveMENt and The MAN Project participants indicate that Atlanta MSM have higher than average numbers of homeless, unemployed, and incarcerated individuals. The national average for homelessness is approximately 0.2% (610,042/318.9 million), while the state of Georgia accounts for between 1-2.9% of the total, approximately 16,971 individuals (35). With 3.7% (8/217) of MSM sampled currently homeless and 9.8% (26/264) homeless at some point in the previous year, the observed prevalence is higher than the national average and previous findings which reported 2.6% homeless among MSM with HIV as homeless (36). The percentage of homeless individuals with at least one STI was even higher at 6.9% (2/29). While the observed counts are high, the difference between those with and without an STI support previous findings which show that adverse life events,

such as homelessness, are associated with an increased risk of acquiring an STI or HIV (16, 23, 37, 38). Though the relationship was not found to be significant (p-value 0.3243), this is likely due to the small sample size. The increase in STI infection among homeless also contributes to syndemic theory that adverse life events increase the risk of acquiring an infection. Homeless individuals are more likely to engage in exchange sex for survival which thereby increases the risk of infection (38). Similarly the percent of unemployed MSM is above that of the national average which is currently 5.5% (39). Unemployment was not seen to differ by STI status with approximately 20% of participants of each status unemployed, which is still much higher than the average unemployment for Georgia (6.3%) (40). The elevated number of unemployed MSM is associated with identifying as a sexual minority, who often times find obtaining employment more difficult than their heterosexual counterparts (16).

The prevalence of STIs in the analysis was above average for the general population, but was not unusual for the MSM population. Chlamydia was the most prevalent STI at 8.7%. Compared to a state average of 514.8 cases per 100,000 this finding is remarkably high, but when compared to other MSM populations which report chlamydia prevalence of 11.3%, the prevalence of chlamydia in Atlanta HIV-negative MSM is unsurprising (4). Gonorrhea follows the same trend with a prevalence of 6.0%, which is again higher than the state average of 143.7 cases per 100,000, but similar to other findings in a population of MSM (4). The prevalence of syphilis in the groups was 1.5%, which is again elevated, but somewhat below average for MSM who account for approximately

75% of reported primary and secondary syphilis cases in the US (4). Only 4 cases were observed in the population, which is the reason why the prevalence was low for this subgroup. Additionally the low sample size masked the association between race and syphilis in the MSM population which has previously shown to be a strong predictor of disease. Black MSM were found to be 5.2 times more likely to acquire syphilis than white MSM (41). In this analysis the 4 cases of syphilis were distributed equally between white and black MSM removing race as a predictor of syphilis.

The location of STI infection for chlamydia and gonorrhea was dramatically different by anatomical site. Urethral infections only represented a small portion of all positive STI tests, 15.4% (6/39). The majority of chlamydia and gonorrhea infections were found through rectal swabs instead. The high prevalence of rectal STIs is worrying due to the association between rectal infection and HIV acquisition (22, 42). The difference between anatomical sites could indicate that MSM are not engaging in insertive and receptive in equal proportions, as men who are more frequently receptive will be more likely to develop one or more STIs rectally. Due to the higher number of STIs in the younger population and the increased number of STIs rectally, there may be a behavioral connection between younger men engaging in risky receptive sex more often than their older counterparts. In teen MSM an association was found between older partners and receptive sex, which would place younger men at higher risk of developing a rectal STI (43). Future study into this population should focus on possible behavioral patterns in men with rectal STIs.

Results from the comparison of STI status and PrEP eligibility guidelines found that the CDC recommendations for PrEP use were not associated with STI status [Appendix A]. Diagnosis of an STI is a clear, objective, indication that an individual is engaging in risky behavior. In light of the association between rectal STI and increased risk of HIV, exclusion of bacterial STI diagnosis from the guidelines is ill-advised, and box B1 of the CDC guideline should be recommended over A1 [Appendix A]. When each question of the guidelines were measured against STI status, certain questions performed better than others at gauging risk. Although the results were not significant, this could be due to the small sample size. For the categories with the highest score and highest risk, the PrEP guidelines performed well, successfully identifying all individuals best suited for PrEP as eligible [Appendix B]. All participants who reported unprotected anal receptive intercourse (URAI), methamphetamine use, more than one HIV positive partner, and more than one time of unprotected insertive anal intercourse were PrEP eligible. This is likely due to the scoring algorithm which placed heavy emphasis on those risk factors to the extent that reporting even one of the aforementioned risks would almost always ensure PrEP eligibility [Appendix B]. Problems arise when self-reporting does not indicate the highest level or risk, but a participant tests positive for an STI. For the number of male partners question, the majority of STI positive men fell in the least risky category of 0-5 partners, while only 2 in the most risky and highest scoring category of 10+ partners. This could be because of the race relationship in Atlanta, where black MSM are at higher risk of acquiring an infection with fewer partners than white MSM (21, 22). This relationship continues outside of Atlanta across the country.

It could therefore be beneficial to examine partner count with racial disparities in mind, since white MSM can likely encounter more partners than black MSM before acquiring an infection.

Another question that performed poorly was knowing the HIV status of any partners. STI positive men were more likely to report no HIV positive partners than 1 or more, placing them in the least risky category. While the number of HIV positive men is still low, it would be beneficial to know if men reported no contact with HIV even when status was unknown. If MSM feel they are not at risk for acquiring HIV, they may be more likely to claim no exposure to HIV when in reality they were unknowingly exposed. This question has merits for sero-discordant couples who know the status of their partner, but may be less useful for MSM who engage in casual sex more often where HIV status is unclear. These results in conjunction with reported inconsistencies in physician understanding of and utilization of PrEP, indicate that clearer guidelines should be established by the CDC.

The analysis benefits from the community-based cohort that was gathered from Atlanta since respondents are more likely to be a random sample than in a clinical setting where higher risk individuals congregate. Due to the cross-sectional nature of the analysis, conclusions about future outcomes and risk are not possible to make. Unfortunately the sample size was relatively small at 265 individuals, but for many variables the data did not suffer from missing information with many variables missing 5% of the observations at most. Responses for individual drug use were low, with few participants indicating use

for any drug other than marijuana. The low counts support previous work in a similar population of black and white MSM from Atlanta which found that self-reported drug use was commonly underreported, especially among black MSM (44). Biological indicators were found to be much more effective in determining the prevalence of drug use in the black MSM population.

Several recommendations can be made based on the results of this analysis. First, given the disproportionate number of positive STI tests by anatomical site more research should be focused on further understanding behavioral or psychosocial reasons leading specifically to rectal infections compared to urethral infections. This could be especially useful since rectal infections are associated with an increased risk in acquiring HIV (22). If certain predictors associated specifically with rectal infections are discovered interventions could be better targeted to MSM who are at high risk of HIV. Secondly, the low counts for self-reported drug use are consistent with previous findings and indicate that biological indicators would be more useful in determining if certain drugs are predictors of acquiring an STI (44). Focusing on biologic indicators would be particularly useful in areas with large numbers of black MSM, such as the South and Atlanta, as black MSM are more likely to underreport drug use through self-reporting. Lastly, PrEP guidelines by the CDC should be revisited to better determine high risk individuals. This analysis found no association between STI infection, an objective measure of risk, and PrEP eligibility. Several aspects of the recommendations should be altered to better suit the MSM population and determine the highest risk individuals.

Tables

Table 1. Characteristics of a Cross-Sectional Sample of HIV Negative MSM from InvolveMENt and MAN Project Participants

	Entire Sample (n=265)		At Least 1 Prevalent STI (n=33)		STI Negative (n=232)	
	No.	**%**	**No.**	**%**	**No.**	**%**
Race						
Black	151	57.0	27	81.8	124	53.5
White	114	43.0	6	18.2	108	46.6
Participant age, years						
18-19	22	8.3	2	6.1	20	8.6
20-24	90	34.0	17	51.5	73	31.5
25-30	74	27.9	6	18.2	68	29.3
30-39	79	29.8	8	24.2	71	30.6
Education						
<HS & HS	45	17.1	9	27.3	36	15.7
Some College	100	38.0	17	51.5	83	36.1
College	118	44.9	7	21.2	111	48.3
Missing	2		0		2	
Income						
<20k	99	39.3	15	48.4	84	38.0
20-30k	36	14.3	7	22.6	29	13.1
30-40k	41	16.3	3	9.7	38	17.2
40-50k	25	9.9	3	9.7	22	10.0
50k+	51	20.2	3	9.7	48	21.7
Missing	13		2		11	
Employment Status						
Yes	207	78.7	26	78.8	181	78.7
No	56	21.3	7	21.2	49	21.3
Missing	2		0		2	
Currently Homeless						
Yes	8	3.7	2	6.9	6	3.2
No	209	96.3	27	93.1	182	96.8
Missing	48		4		44	
Homeless Ever						
Yes	26	9.8	4	12.1	22	9.5
No	238	90.2	29	87.9	209	90.5
Missing	1		0		1	

Arrested Ever						
Yes	77	29.2	9	27.3	68	29.4
No	187	70.8	24	72.7	163	70.6
Missing	1		0		1	
Arrested in Past 12 Months						
Yes	22	8.3	2	6.1	20	8.7
No	242	91.7	31	93.9	211	91.3
Missing	1		0		1	
Circumcised						
Yes	207	87.7	25	86.2	182	87.9
No	27	11.4	4	13.8	23	11.1
Unsure	2	0.8	0	0.0	2	1.0
Missing	29		4		25	
Health Insurance						
Yes	174	66.2	17	51.5	157	68.3
No	85	32.3	16	48.5	69	30.0
Refuse	4	1.5	0	0.0	4	1.7
Missing	2		0		2	
Number of Male Partners Past 6 Months						
0-2	87	33.1	8	24.2	79	34.4
3-5	111	42.2	15	45.5	96	41.7
6+	65	24.7	10	30.3	55	84.6
Missing	2		0		2	
Number of Male Partners Past 12 Months						
0-2	39	14.8	4	12.1	35	15.2
3-5	96	36.5	12	36.4	84	36.5
6+	128	48.7	17	51.5	111	48.3
Missing	2		0		2	
Number of Male AI[a] Partners Past 6 Months						
0-2	149	56.9	15	45.5	134	58.5
3-5	70	26.7	12	36.4	58	25.3
6+	43	16.4	6	18.2	37	16.2
Missing	2		0		3	
Number of Male UAI[b] Partners Past 6 Months						
0-2	221	84.4	27	81.8	194	84.7
3-5	30	11.5	4	12.1	26	11.4
6+	11	4.2	2	6.1	9	3.9
Missing	3		0		3	
Number of Male Casual Partners Past 12 Months						
0-2	84	31.9	11	33.3	73	31.7
3-5	84	31.9	9	27.3	75	32.6
6+	95	36.1	13	39.4	82	35.7

Missing	3		0		3	
Number of Male Main Partners Past 12 Months						
0-2	214	81.4	25	75.8	189	82.2
3-5	42	16.0	8	24.2	34	14.8
6+	7	2.7	0	0.0	7	3.0
Missing	2		0		3	
Any Drug Use						
Yes	90	34.0	8	24.2	82	35.3
No	171	64.5	25	75.8	146	62.9
Missing	4	1.5	0	0.0	4	1.7
Any Injection Drug Use						
Yes	2	0.8	1	3.0	1	0.4
No	262	98.9	32	97.0	230	99.1
Missing	1	0.4	0	0.0	1	0.4
Any Non-Injection Drug Use						
Yes	90	34.0	8	24.2	82	35.3
No	171	64.5	25	75.8	146	62.9
Missing	4	1.5	0	0.0	4	1.7
Marijuana Use						
Yes	80	30.2	7	21.2	73	31.5
No	185	69.8	26	78.8	159	68.5
Powdered Cocaine Use						
Yes	30	11.3	2	6.1	28	12.1
No	235	88.7	31	93.9	204	87.9
Crack Cocaine Use						
Yes	1	0.4	0	0.0	1	0.4
No	264	99.6	33	100.0	231	99.6
Crystal Meth Use						
Yes	5	1.9	1	3.0	4	1.7
No	260	98.1	32	97.0	228	98.3
Downer Use (Ativan, Valium, or Xanax)						
Yes	11	4.2	2	6.1	9	3.9
No	254	95.8	31	93.9	223	96.1
Ecstacy Use						
Yes	22	8.3	4	12.1	18	7.8
No	243	91.7	29	87.9	214	92.2
GHB Use						
Yes	5	1.9	0	0.0	5	2.2
No	260	98.1	33	100.0	227	97.8
Hallucinogen Use (LSD or Mushrooms)						
Yes	9	3.4	1	3.0	8	3.4
No	256	96.6	32	97.0	224	96.6
Heroin Use (Snorted or Smoked)						

Yes	0	0.0	0	0.0	0	0.0
No	265	100.0	33	100.0	232	100.0
Popper (Amyl Nitrate) Use						
Yes	24	9.1	3	9.1	21	9.1
No	241	90.9	30	90.9	211	90.9
Painkiller Use (Oxycontin, Vicodin, or Percocet)						
Yes	22	8.3	3	9.1	19	8.2
No	243	91.7	30	90.9	213	91.8
Special K (Ketamine) Use						
Yes	1	0.4	0	0.0	1	0.4
No	264	99.6	33	100.0	231	99.6

[a] Anal Intercourse

[b] Unprotected Anal Intercourse

Table 2. Bivariate Analysis of Characteristics of a Cross-Sectional Sample of HIV Negative MSM from InvolveMENt and MAN Project Participants At least 1 Prevalent STI Compared to No STI

	STI		Prev. per 100	POR	95% CI		P-Value
	Yes	No					
Race							
White[R]	6	108	5.3	--	--	--	--
Black	27	124	17.9	3.92	1.56	9.85	**0.0021**
Participant age, years							
18-19	2	20	9.1	0.89	0.17	4.52	0.8856
20-24	17	73	18.9	2.07	0.84	5.09	0.1094
25-30	6	68	8.1	0.78	0.26	2.38	0.6652
30-39[R]	8	71	10.1	--	--	--	--
Education							
<HS & HS[R]	9	36	20.0	--	--	--	--
Some College	17	83	17.0	0.82	0.33	2.01	0.6631
College	7	111	5.9	0.25	0.09	0.73	**0.0070**
Income							
<20k[R]	15	84	15.2	--	--	--	--
20-30k	7	29	19.4	1.35	0.50	3.64	0.5504
30-40k	3	38	7.3	0.44	0.12	1.62	0.2076
40-50k	3	22	12.0	0.76	0.20	2.87	0.6984
50k+	3	48	5.9	0.35	0.10	1.27	0.0979
Employment Status							
Yes[R]	26	181	12.6	--	--	--	--
No	7	49	12.5	0.99	0.41	2.43	0.9903
Currently Homeless							
Yes[R]	2	6	25.0	--	--	--	--
No	27	182	12.9	0.45	0.09	2.32	0.3243
Homeless Ever							
Yes[R]	4	22	15.4	--	--	--	--
No	29	209	12.2	0.76	0.25	2.37	0.6395
Arrested Ever							
Yes[R]	9	68	11.7	--	--	--	--
No	24	163	12.8	1.11	0.49	2.52	0.7980
Arrested in Past 12 Months							
Yes[R]	2	20	9.1	--	--	--	--
No	31	211	12.8	1.47	0.33	6.60	0.6136

Circumcised							
Yes[R]	25	182	14.8	--	--	--	--
No	4	23	12.1	0.79	0.25	2.47	0.6847
Health Insurance							
Yes[R]	17	157	9.8	--	--	--	--
No	16	69	18.8	2.14	1.02	4.48	**0.0402**
Number of Male Partners Past 6 Months							
0-2[R]	8	79	9.2	--	--	--	--
3-5	15	96	13.5	1.5	0.6	3.8	0.3466
6+	10	55	15.4	1.8	0.7	4.8	0.2427
Number of Male Partners Past 12 Months							
0-2[R]	4	35	10.3	--	--	--	--
3-5	12	84	12.5	1.3	0.4	4.1	0.1747
6+	17	111	13.3	1.3	0.4	4.2	0.6179
Number of Male AI[a] Partners Past 6 Months							
0-2[R]	15	134	10.1	--	--	--	--
3-5	12	58	17.1	1.8	0.8	4.2	0.1375
6+	6	37	14.0	1.4	0.5	4.0	0.4720
Number of Male UAI[b] Partners Past 6 Months							
0-2[R]	27	194	12.2	--	--	--	--
3-5	4	26	13.3	1.1	0.4	3.4	0.8616
6+	2	9	18.2	1.6	0.3	7.8	0.5593
Number of Male Casual Partners Past 12 Months							
0-2[R]	11	73	13.1	--	--	--	--
3-5	9	75	10.7	0.8	0.3	2.0	0.6337
6+	13	82	13.7	1.1	0.4	2.5	0.9081
Number of Male Main Partners Past 12 Months							
0-2[R]	25	189	11.7	--	--	--	--
3-5	8	34	19.1	1.8	0.7	4.3	0.1928
6+	0	7	--	--	--	--	--
Any Drug Use							
Yes[R]	8	82	8.9	--	--	--	--
No	25	146	14.6	1.76	0.76	4.07	0.1854
Any Injection Drug Use							
Yes[R]	1	1	50.0	--	--	--	--
No	32	230	12.2	0.14	0.01	2.28	0.1075
Any Non-Injection Drug Use							
Yes[R]	8	82	8.9	--	--	--	--

No	25	146	14.6	1.76	0.76	4.07	0.1854
Marijuana Use							
Yes[R]	7	73	8.8	--	--	--	--
No	26	159	14.1	1.71	0.71	4.11	0.2299
Powdered Cocaine Use							
Yes[R]	2	28	6.7	--	--	--	--
No	31	204	13.2	2.13	0.48	9.38	0.3081
Crack Cocaine Use							
Yes[R]	0	1	--	--	--	--	--
No	33	231	12.5	--	--	--	--
Crystal Meth Use							
Yes[R]	1	4	20.0	--	--	--	--
No	32	228	12.3	0.56	0.06	5.18	0.6060
Downer Use (Ativan, Valium, or Xanax)							
Yes[R]	2	9	18.2	--	--	--	--
No	31	223	12.2	0.63	0.13	3.03	0.5567
Ecstacy Use							
Yes[R]	4	18	18.2	--	--	--	--
No	29	214	11.9	0.61	0.19	1.93	0.3954
GHB Use							
Yes[R]	0	5	--	--	--	--	--
No	33	227	14.5	--	--	--	--
Hallucinogen Use (LSD or Mushrooms)							
Yes[R]	1	8	11.1	--	--	--	--
No	32	224	12.5	1.14	0.14	9.44	0.9013
Heroin Use (Snorted or Smoked)							
Yes[R]	0	0	--	--	--	--	--
No	33	232	12.5	--	--	--	--
Popper (Amyl Nitrate) Use							
Yes[R]	3	21	12.5	--	--	--	--
No	30	211	12.5	1.00	0.28	3.54	0.9941
Painkiller Use (Oxycontin, Vicodin, or Percocet)							
Yes[R]	3	19	12.4	--	--	--	--
No	30	213	12.4	0.89	0.25	3.20	0.8610
Special K (Ketamine) Use							
Yes[R]	0	1	--	--	--	--	--
No	33	231	12.5				

[R] Referent Group

Table 3. Characteristics of Prevalent STI in a Cross-Sectional Sample of HIV Negative MSM from InvolveMENt and MAN Project Participants

	Chlamydia		Gonorrhea		Syphilis		Multiple Infections	
	Yes	**%**	**Yes**	**%**	**Yes**	**%**	**Yes**	**%**
STI Location								
Urethra	1	4.3	3	18.8	0	0.0	0	0.0
Rectum	18	78.3	13	81.3	0	0.0	8	80.0
Blood	0	0.0	0	0.0	4[a]	100.0	0	0.0
Both	2	8.7	0	0.0	0	0.0	2[b]	20.0
Race								
White	4	17.4	1	6.3	2	0.8	1	10
Black	19	82.6	15	93.8	2	50	9	90
Participant age, years								
18-19	1	4.3	1	6.3	0	0	0	0
20-24	13	56.5	8	50	2	50	6	60
25-30	4	17.4	5	31.3	0	0	3	30
30-39	5	21.7	2	12.5	2	50	1	10
Education								
< High School	0	0	0	0	0	0	0	0
High School	7	30.4	3	18.8	2	50	3	30
Some College	13	56.5	8	50	2	50	6	60
College	3	13	5	31.3	0	0	1	10
Income								
<20k	12	52.2	6	37.5	2	50	5	50
20-30k	4	17.4	4	25	0	0	1	10
30-40k	1	4.3	0	0	2	50	0	0
40-50k	3	13	1	6.3	0	0	1	10
50k+	1	4.3	3	18.8	0	0	1	10
Employment Status								
Yes	18	78.3	12	75	4	100	8	80
No	5	21.7	4	25	0	0	2	20
Currently Homeless								
Yes	2	8.7	1	6.3	0	0	1	10
No	18	78.3	12	75	4	100	7	70
Homeless Ever								
Yes	3	13	2	12.5	1	25	2	20
No	20	87	14	87.5	3	75	8	80
Arrested Ever								
Yes	6	26.1	4	25	3	75	4	40

No	17	73.9	12	75	1	25	6	60
Arrested in Past 12 Months								
Yes	2	8.7	1	6.3	1	25	1	10
No	21	91.3	15	93.8	3	75	8	80
Circumcised								
Yes	17	73.9	12	75	3	75	7	70
No	3	13	1	6.3	1	25	1	10
Health Insurance								
Yes	11	47.8	8	50	2	50	4	40
No	12	52.2	8	50	2	50	6	60
Number of Male Partners Past 6 Months								
0-2	5	21.7	4	25.0	0	0.0	1	10.0
3-5	12	52.2	5	31.3	3	75.0	5	50.0
6+	6	26.1	7	43.8	1	25.0	4	40.0
Number of Male Partners Past 12 Months								
0-2	2	8.7	3	18.8	0	0.0	1	10.0
3-5	10	43.5	4	25.0	1	25.0	3	30.0
6+	11	47.8	9	56.3	3	75.0	6	60.0
Number of Male AI[a] Partners Past 6 Months								
0-2	10	43.5	7	43.8	1	25.0	3	30.0
3-5	9	39.1	4	25.0	2	50.0	3	30.0
6+	4	17.4	5	31.3	1	25.0	4	40.0
Number of Male UAI[b] Partners Past 6 Months								
0-2	19	82.6	12	75.0	2	50.0	6	60.0
3-5	2	8.7	2	12.5	2	50.0	2	20.0
6+	2	8.7	2	12.5	0	0.0	2	20.0
Number of Male Casual Partners Past 12 Months								
0-2	8	34.8	7	43.8	0	0.0	4	40.0
3-5	7	30.4	1	6.3	3	75.0	2	20.0
6+	8	34.8	8	50.0	1	25.0	4	40.0
Number of Male Main Partners Past 12 Months								
0-2	17	73.9	11	68.8	2	50.0	5	50.0
3-5	6	26.1	5	31.3	2	50.0	5	50.0
6+	0	0.0	0	0.0	0	0.0	0	0.0
Any Drug Use								
Yes	7	30.4	3	18.8	2	50	4	40
No	16	69.6	13	81.3	2	50	6	60
Any Injection Drug Use								
Yes	1	4.3	0	0	1	25	1	10
No	22	95.7	16	100	3	75	9	90
Any Non-Injection Drug Use								
Yes	7	36.8	3	18.8	2	50	4	40

No	12	63.2	13	81.3	2	50	6	60
Marijuana Use								
Yes	6	66.7	2	33.3	2	100	3	50
No	3	33.3	4	66.7	0	0	3	50

[a] Syphilis test indicates detection in blood

[b] 2 multiple infections: 1 Chlamydia - Rectum and Syphilis 1 Chlamydia-Rectum & Gonorrhea - Urethra

Table 4. PrEP Eligibility of a Cross-Sectional Sample of HIV Negative MSM from InvolveMENt and MAN Project Participants

	At Least 1 Prevalent STI (n=21)		No STI (n=162)		P-Value
	% PrEP	(Total)	% PrEP	(Total)	
PrEP Overall					
Eligible	61.9	(13/21)	59.3	(96/162)	0.8162
PrEP Score - Age Categories					
18-28	60.0	(9/15)	61.8	(68/110)	0.892
29-40	60.0	(3/5)	56.1	(23/41)	0.868
41-48	0.0	(0/0)	50.0	(3/6)	--
49+	100.0	(1/1)	40.0	(2/5)	0.2733
PrEP Score - Male Partner Count					
0-5	50.0	(8/16)	47.0	(54/115)	0.8193
6-10	100.0	(5/5)	87.1	(27/31)	0.3942
10+	0.0	(0/0)	93.8	(15/16)	--
PrEP Score - Unprotected Receptive Anal Sex					
0	33.3	(4/12)	34.0	(34/66)	0.9632
1	100.0	(9/9)	100.0	(62/62)	--
PrEP Score - Number of HIV Positive Partners					
0	60.0	(12/20)	56.3	(81/63)	0.7511
1	100.0	(1/1)	80.0	(12/15)	0.6198
1+	0.0	(0/0)	100.0	(3/3)	--
PrEP Score - Unprotected Insertive Anal Sex					
0	50.0	(8/16)	51.1	(69/135)	0.933
1	100.0	(5/5)	100.0	(27/27)	--
PrEP Score - Self-Reported Methamphetamine Use					
Yes	0.0	0	100.0	(10/10)	--
No	61.9	(13/21)	56.6	(86/152)	0.6438

Appendices

A. CDC Guidelines for High Risk Individuals suited to PrEP

BOX A1: RISK BEHAVIOR ASSESSMENT FOR MSM[36]

In the past 6 months:

- Have you had sex with men, women, or both?
- *(if men or both sexes)* How many men have you had sex with?
- How many times did you have receptive anal sex (you were the bottom) with a man who was not wearing a condom?
- How many of your male sex partners were HIV-positive?
- *(if any positive)* With these HIV-positive male partners, how many times did you have insertive anal sex (you were the top) without you wearing a condom?
- Have you used methamphetamines (such as crystal or speed)?

BOX B1: RECOMMENDED INDICATIONS FOR PREP USE BY MSM[2]

- Adult man
- Without acute or established HIV infection
- Any male sex partners in past 6 months (if also has sex with women, see Box B2)
- Not in a monogamous partnership with a recently tested, HIV-negative man

AND at least one of the following

- Any anal sex without condoms (receptive or insertive) in past 6 months
- Any STI diagnosed or reported in past 6 months
- Is in an ongoing sexual relationship with an HIV-positive male partner

B. PrEP Eligibility Scoring Algorithm based on CDC Guidelines Box A1.

PrEP Eligibility Scoring

PrEP Eligibility was positive if a participant's score for all questions was greater than or equal to 10.

1. Participant's Age
    a. 18-28 years 8 points
    b. 29-40 years 5 points
    c. 41-48 years 2 points
    d. 49+ years 0 points
2. Male Partner Count

   a. 0-5 partners 0 points
   b. 6-10 partners 4 points
   c. More than 10 7 points
3. Number Times of Unprotected Receptive Anal Intercourse
   a. 0 times 0 points
   b. More than 1 10 points
4. HIV Status of Partner(s)
   a. 0 HIV+ partners 0 points
   b. 1 HIV+ partner 4 points
   c. >1 HIV+ partner 8 points
5. Number Times of Unprotected Insertive Anal Intercourse
   a. 0 times 0 points
   b. More than 1 6 points
6. Self-Reported Methamphetamine Use
   a. Yes Use 6 points
   b. No Use 0 points

References

1. Control CfD. Diagnoses of HIV Infection in the United States, 2013: Centers for Disease Control; 2014.

2. Scott HM, Bernstein KT, Raymond HF, Kohn R, Klausner J. Racial/Ethnic and Sexual Behavior Disparities in Rates of Sexually Transmitted Infections, San Francisco, 1999-2008. BMC Public Health 2010;10.

3. Sullivan P, Peterson J, Rosenberg E, Kelley C, al e. Understanding Racial HIV/STI Disparities in Black and White Men who have Sex with Men: A Multilevel Approach. In: PLOS One; 2014.

4. Control CfD. Sexually Transmitted Disease Surveillance, 2013. Atlanta, GA: Centers for Disease Control; 2014.

5. Scott K, Philip S, Ahrens K, al e. High Prevalence of Gonococcal and Chlamydial Infection in Men Who Have Sex With Men With Newly Diagnosed HIV Infection: An Opportunity for Same-Day Presumptive Treatment. Journal of Acquired Immune Dificiency Syndromes 2008;48(1).

6. Lafferty W, Hughes J, Handsfield H. Sexually transmitted diseases in men who have sex with men. Acquisition of gonorrhea and nongonococcal urethritis by fellatio and implications for STD/HIV prevention. Sexually Transmitted Diseases 1997;25(5):272-278.

7. Control CfD. Syphilis & MSM (Men who have Sex with Men) - CDC Fact Sheet. In: Centers for Disease Control; 2014.

8. McAuliffe T, DiFranceisco W, Reed B. Sexually transmitted diseases in men who have sex with men. Acquisition of gonorrhea and nongonococcal urethritis by fellatio and implications for STD/HIV prevention. Health Psychology 2007;26(1):60-67.

9. Fleming D, Wasserheit J. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sexually Transmitted Infections 1999;75:3-17.

10. Cohen M, Hiffman I, Royce R. Reduction of concentration of HIV-1 in semen after treatment of urethritis: implications for prevention of sexual transmission of HIV-1. Lancet 1996;349:1968-1973.

11. Moss G, Overbaugh J, Welch M, al e. Human immunodeficiency virus DNA in urethral secretions in men: association with gonococcal urethritis and CD4 cell depletion. Journal of Infectious Disease 1995;172:2767-2774.

12. Jin F, Prestage G, Mao L, Poynten I, Templeton D, Grulich A, et al. "Any Condomless Anal Intercourse" is No Longer an Accurate Measure of HIV Sexual risk Behavior in Gay and Other Men Who have Sex with Men. Frontiers in Immunology 2015;6(86).

13. Rieg G, Lewis R, Miller L, Witt M, Guerrero M, Daar E. Asymptomatic sexually transmitted infections in HIV-infected men who have sex with men: prevalence, incidence, predictors, and screening strategies. AIDS Patient Care STDS 2008;22(12):947-954.

14. Keaveney S, Sadlier C, O'Dea S, Delamere S, Bergin C. High prevalence of asymptomatic sexually transmitted infections in HIV-infected men who have sex with men: a stimulus to improve screening. Internation Journal of STD & AIDS 2014;10:758-761.

15. Safren S, Reisner S, Herrick A, al e. Mental Health and HIV Risk in Men who have Sex with Men. Journal of Acquired Immune Dificiency Syndromes 2010;55(2):S74-77.

16. IH M. Prejudice, Social Stress, and Mental Health in Lesbian, Gay, and Bisexual Populations: Conceptual Issues and Research Evidence. Psychological Bulletin 2003;129(5):674-697.

17. Singer M. AIDS and the Health Crisis of the U.S. Urban Poor; the Perspective of Critical Medical Anthropology. Social Science & Medicine 1994;39(7):931-948.

18. Stall R, Mills T, Williamson J, al e. Association of Co-Occurring Psychosocial Health Problems and Increased Vulnerability to HIV/AIDS among Urban Men who have Sex with Men. American Journal of Public Health 2003;93(6):939-942.

19. Vaughn A, Rosenberg E, Sullivan P. Spatial Relationships Between Gay Stigma, Poverty, and HIV Infection Among Black and White Men who have Sex with Men in Atlanta. AIDS Research and Human Retroviruses 2014

30(8):740-741.

20. Helth GDoP. National HIV Behavioral Surveillance Secondary Data Report: Men who have Sex with Men, Cycle 3 (MSM3): Georgia Department of Public Health; 2011.

21. Kelley C, Rosenberg E, O'Hara B, Frew P, Sanchez T, Peterson J, et al. Measuring Population Transmission Risk for HIV: An Alertnative Metric of Exposure Risk in Men who have Sex with Men (MSM) in the US. In: PLOS One; 2012.

22. Kelley C, Vaughn A, Luisi N, Sanchez T, Salazar L, Frew P, et al. The Effect of High Rates of Bacterial Sexually Transmitted Infections on HIV Incidence in a Cohort of Black and White Men who have Sex with Men in Atlanta, Georgia. In: AIDS Research and Human Retroviruses; 2015.

23. Stokes J, Vanable P, McKirnan D. Ethnic Differences in Sexual Behavior, Condom Use, and Psychosocial Variables Among Black and White Men who have Sex with Men. Journal of Sex Research 1996;33:373-381.

24. Malebranche D, Peterson J, Fullilove R, al e. Race and Sexual Identity: Perceptions about Medical Culture and Healthcare among Black Men who have Sex with Men. Journal of the National Medical Association 2004;96(1):97-107.

25. Control CfD. Pre-exposure Prophylaxis (PrEP) for HIV Prevention. In: Control CfD, editor.; 2014.

26. Grant R, Lama J, Anderson P, McMahan V, al e. Preexposure Chemoprophylaxis for HIV Prevention in Men who have Sex with Men. The New England Journal of Medicine 2010;363:2587-2599.

27. Baeten J, Donnell D, Ndase P, Mugo N, al e. Antiretroviral Prophylaxis for HIV-1 Prevention among Heterosexual Men and Women. The New England Journal of Medicine 2012;367(5):399-410.

28. Kessler J, Myers J, Nucifora K, Mensah N, al e. Evaluating the Impact of Prioritization of Antiretroviral Pre-exposure Prophylaxis in New York. AIDS 2014;28(18):2683-2691.

29. Control CfD. Pre-exposure Prophylaxis for the Prevention of HIV Infection in the United States - 2014: Centers for Disease Control; 2014.

30. Karris M, Beekmann S, Mehta S, Anderson C, Polgreen P. Are We Prepped for Preexpsoure Prophylaxis (PrEP)? Provider Opinions on the Real-World Use of PrEP in the United States and Canada. Clinical Infectious Disease 2014;58(5):704-712.

31. Smith D, Grant R, Weidle P, Lansky A, Mermin J, Fenton K. Interim Guidance: Pre-Exposure Prophylaxis for the Prevention of HIV Infection in Men who have Sex with Men. In: Morbidity and Mortality Weekly Report: Centers for Disease Control; 2011.

32. Smith D, Thigpen M, Nesheim S, al e. Interim Guidance for Clinicans Considering the Use of Pre-exposure Prophylaxis for Prevention of HIV Infection in Heterosexually Active Adults. In: Morbidity and Mortality Weekly Report: Centers for Disease Control; 2012.

33. Mullins T, Lally M, Zimet G, Kahn J. Clinican Attitudes toward CDC Interim Pre-Exposure Prophylaxis (PrEP) Guidance and Opertionalizing PrEP for Adolescents. AIDS Patient Care STDS 2015;29(4):193-203.

34. Control CfD. Preexposure Prophylaxis for the Prevention of HIV Infection in the UNited States - 2014: A Clincial Practice Guideline: Centers for Disease Control; 2014.

35. Henry M, Cortes A, Morris S. The 2013 Annual Homeless Assesment Report (AHAR) to Congress: The US Department of Housing and Urban Development; 2013.

36. Kidder D, Wolitski R, Pals S, Campsmith M. Housng Status and HIV Risk Behaviors among Homeless and Housed Persons with HIV. Journal of Acquired Immune Dificiency Syndromes 2008;49(4):451-455.

37. Figueroa J, Cooper C, Edwards J, Byfield L, Eastman S, Hobbs M, et al. Understanding the High Prevalence of HIV and other Sexually Transmitted Infections among Socio-Economically Vulnerable Men who have Sex with Men in Jamaica. PLOS One 2015;10(2).

38. Santos G, Do T, Makofane K, Arreola S, Pyun T, Hebert P, et al. Syndemic Conditions Associated with Increased HIV Risk in a Global Sample of Men who have Sex with Men. Sexually Transmitted Infections 2014;90(3):250-253.

39. Statistics BoL. Databases, Tables & Calculators by Subject: US Unemployment Rate. In: United States Department of Labor; 2015.

40. Statistics BoL. Local Area Unemployment Statistics: Unemployment Rates for States. In: United States Department of Labor; 2015.

41. Patton M, Su J, Nelson R, Weinstock H. Primary and Secondary Syphilis - United States 2005-2013. Morbidity and Mortality Weekly Report 2014;63(18):402-406.

42. Bernstein K, Marcus J, Nieri G, Philip S, Klausner J. Rectal Gonorrhea and Chlamydia Reinfection is Associated with Increased Risk of HIV Seroconversion. Journal of Acquired Immune Dificiency Syndromes 2010;53(4):537-543.

43. Zou H, Prestage G, Fairley C, Grulich A, al e. Sexual Behaviors and Risk for Sexually Transmitted Infections among Teenage Men who have Sex with Men. Journal of Adolsecent Health 2014;55(2):247-253.

44. White D, Rosenberg E, Cooper H, del Rio C, Sanchez T, Salazar L, et al. Racial Difference in the Validity of Self-Reported Drug Use among Men who have Sex with Men in Atlanta, GA. Drug and Alcohol Dependence 2014;138:146-153.