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Syphilis and HIV Seroconversion Among a 12-Month Prospective Cohort of Men Who Have Sex With Men in Shenyang, China

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Abstract

Background—Cross-sectional studies have found a high prevalence of syphilis and HIV infection among men who have sex with men (MSM) in China.

Methods—A total of 218 HIV-negative MSM participated in this prospective cohort study. Interviewer-administered questionnaires were completed, and blood samples were obtained for HIV and syphilis testing, both upon enrollment and at 12-month follow-up.

Results—Of enrolled participants, 56% (122) were retained for the full 12-month follow-up period. The cohort had an HIV incidence density of 5.4 (95% CI: 2.0–11.3)/100 person-year (PY) and a syphilis incidence density of 38.5 (95% CI: 27.7–50.2)/100 PY. Having syphilis (odds ratio [OR]: 11.4, 95% CI: 1.2–104.7) and more than 5 male sexual partners within the past 12 months (OR: 6.5, 95% CI: 1.1–39.8) were independent risk factors for HIV seroconversion (each $P < 0.05$). Being married (OR: 3.5, 95% CI: 1.4–8.2) and having more than 5 male sexual partners within the past 12 months (OR: 4.7, 95% CI: 2.0–6.2) were risk factors for syphilis seroconversion, while age ≥ 30 (OR 2.1, 95% CI 0.7–9.5) and having recently engaged in unprotected receptive anal sex (OR: 2.4, 95% CI: 0.7–13.1) were marginally associated with syphilis seroconversion.

Conclusion—The high incidence rates of HIV and syphilis in the Shenyang MSM community are significant cause for concern. The seroconversion rate for syphilis, in particular, indicates the high prevalence of high-risk sexual behaviors and the potential for increased HIV transmission. Appropriate interventions that address MSM-specific issues, including stigma, pressures from traditional society, and bisexual behavior, need to be tailored to inform and empower MSM in order to prevent HIV and syphilis in this community.

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As the HIV epidemic within China grows, understanding dynamics of the epidemic among men who have sex with men (MSM) is becoming increasingly important. Of the 50,000 estimated new infections in Mainland, China in 2007, 12.2% were MSM.¹ The HIV prevalence within this subpopulation appears to be rising rapidly. In 2005, only 0.4% of those infected with HIV were estimated to be men who contracted the virus through sex with other men. However, in 2007, about 3.3% of all those infected in the general population were believed to have been transmitted through homosexual sex.¹ Still, little is known about the HIV epidemic within this subpopulation and having a better understanding of the incidence, HIV risk-factors, and demographics of MSM is an important step toward building HIV interventions that target MSM in China.¹

In recent years, sexual transmission has become the major route of HIV transmission in China. The epidemic within MSM is of particular concern because this subpopulation could become a bridge of infection to the general population. One recent qualitative study on Shanghai MSM found that homosexuality is still highly stigmatized in China, and MSM may engage in heterosexual activity as well in order to avoid discrimination.² In a 2003 survey of MSM, Zhang et al. found that the majority of participants were currently married, had been married, or had sexual experience with a woman.³ In another study, Feng et al. reported that married MSM had a significantly higher HIV prevalence than nonmarried MSM.⁴ Thus, MSM in China may pose a significant risk to the spread of HIV to the general population through their female sexual partners.⁵

Unprotected sexual behavior is a major risk factor for the transmission of both HIV and syphilis. However, syphilis is more infectious than HIV and characterizing the syphilis epidemic has significant implications for further understanding the HIV epidemic and its associated risk behaviors in the MSM community.⁶ Recent studies have found alarmingly high syphilis prevalence rates in some Chinese MSM communities, with prevalence rates as high as 19.3%.^{7,8} Moreover, being infected with ulcerative sexually transmitted diseases (STIs), like syphilis, increases the probability of contracting HIV during unprotected anal and oral sex.^{7,9-11} The similar modes of infection for HIV and syphilis, recent high syphilis prevalence rates in Chinese MSM communities, and the role of syphilis as a cofactor in HIV transmission make syphilis of a high concern as high syphilis rates could be indicative of higher HIV infection rates in this community in the future.⁴

Shenyang, the site of this study, is an economic, cultural, and industrial hub and is distinct from other Chinese cities in several ways. First, Shenyang has the second largest MSM population in China (after Beijing) with an estimated 140,000 MSM.¹² Second, a previous study in 2004 found that the prevalence of HIV in this subpopulation was low (1%), while syphilis prevalence was high (20.8%).¹³ MSM studies in other cities such as Beijing, Nanjing, Guangzhou, and Chengdu found high rates of both HIV (Beijing 3.2%,¹¹ Nanjing 4.7%,¹⁴ Guangzhou 1.3%,¹⁵ Chengdu 9.1% to 12.5%^{4,16}) and syphilis (Beijing 11.2%,¹¹ Nanjing 26.7%,¹⁴ Guangzhou 14.8%,¹⁵ Chengdu 28.1%¹⁷) infection. Because of the compounding and overlapping risk factors for syphilis and HIV, the disparate HIV and syphilis rates in Shenyang may indicate a future change in the HIV epidemic. Nearly 60% of those found HIV-positive in HIV/AIDS clinic of the First Affiliated Hospital, China Medical University self-identified as MSM, which also suggests that prevalence rates in Shenyang

MSM may have increased since the 2004 survey. Quantifying HIV/syphilis incidence and exploring HIV/syphilis seroconversion-related risk factors are important steps to help characterize the changing HIV/syphilis epidemic in Shenyang and to inform future interventions.

In this prospective cohort study, we analyzed the incidence rates of HIV and syphilis in Shenyang MSM. Few other studies on HIV and syphilis in MSM maintain a cohort to explore incidence rates and HIV/syphilis-related risk factors.^{18,19} Exploring HIV and syphilis incidence rates in MSM will help to clarify the dynamics of the 2 epidemics and to provide rationale for building interventions targeted toward MSM in China.

METHODS

Study Design and Participants Enrollment

Between August and September 2006, MSM were recruited through a non-government organization, Shenyang Sunny Workgroup, which provides health education outreach to Shenyang MSM. Non-government organization staff approached MSM at Shenyang Sunny Workgroup to participate in a screening survey to determine eligibility for the study. They were notified in the screening process that they would be tested for HIV and syphilis. Those approached were also asked to refer MSM peers that would be eligible and willing to participate. Those eligible to participate were male, HIV-negative, at least 18 years of age, had reported having at least 1 male sexual partner with whom he had had receptive and/or insertive anal sex in the past 12 months, were physically able and willing to provide written informed consent, and were willing to participate in the 12-month follow-up survey. Recruited individuals were interviewed at baseline and their eligibility was confirmed through HIV antibody testing. Interviews were once again conducted and blood samples were obtained and tested for HIV and syphilis at the 12-month follow-up visit. Those who tested positive for syphilis and/or HIV were referred to treatment at the First Affiliated Hospital of the China Medical University. All MSM participants, including HIV and/or syphilis positive MSM, were given general information about syphilis and HIV and were informed how to practice safe sexual behaviors during the course of the pre- and posttest counseling provided by this study. Written informed consent was obtained before the baseline interview and testing. Participants were compensated 50 RenMinBi (RMB) [about 7 United States Dollar (USD)] for their time. The study protocol and informed consent forms were approved by the Institutional Review Board of the first affiliated hospital of China Medical University.

Data Collection

Data on demographics, sexual behavior, drug use, and history of sexually transmitted diseases (STDs) were collected through standardized questionnaires administered by trained physicians from the first affiliated hospital of China Medical University. Participants' questionnaires were linked to blood specimen in the follow-up through assignment of a unique identifier code.

Laboratory Testing

Sera were tested for HIV and syphilis antibodies. The presence of HIV-1 antibody was tested for through enzyme-linked immunosorbent assay (Vironostika HIV-1 Microelisa System; BioMérieux, Durham, NC). Positive tests were confirmed by HIV-1/2 Western blot assay (HIV Blot 2.2 WB; Genelabs Diagnostics, Singapore). Syphilis serology was determined through rapid plasma reagin (RPR, Diagnosis t; Shanghai Kehua, China). Plasma specimens that were positive for RPR were confirmed by *Treponema pallidum* particle assay (TPPA, Serodia, Japan). Participants were initially tested by TPPA, positive TPPA cases were also tested by RPR. Subjects with plasma positive for both TPPA and RPR were determined to be currently infected with syphilis. Baseline RPR negative cases that turned positive for both TPPA and RPR at follow-up were defined as syphilis seroconverted. In addition, baseline TPPA negative cases that turned TPPA positive (RPR negative and positive) were legible cases for observation of syphilis seroconversion during the follow-up period.

Data Analysis

Questionnaires were double entered and then checked for accuracy using Epi Data software (The Epi Data Association Odense, Denmark, version 3.02). Data were then analyzed using SAS 9.1 (SAS Institute Inc., Cary, NC).

HIV and syphilis infection were estimated to have been transmitted at the midpoint between the time of baseline HIV-1/syphilis test and the time of the follow-up HIV-1/syphilis test with a seropositive result. HIV incidence density was calculated based on the Poisson distribution, with person-year (PY) of follow-up as the denominator. HIV and syphilis incidence were calculated based on the retained MSM cohort. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. Categorical data were described and analyzed by frequency and χ^2 tests. Continuous variables were described with the mean and non-normally distributed continuous variables were described with the median. Univariate logistic regression and stepwise multivariate logistic regression were used to determine adjusted odds ratios (aOR) for HIV and syphilis seroconversion related risk-factors. Marginally significant variables with $P < 0.25$ in univariate analysis were included in multivariate analysis. Only variables with $P < 0.1$ were kept in the last multivariate logistic model in a stepwise manner.

RESULTS

Baseline Demographic Characteristics of MSM Participants

A total of 235 MSM were approached to participate in the study and 4 of those approached were not eligible because they were less than 18 years of age. Of total, 231 MSM were enrolled and invited to attend a baseline screening survey and 13 (5.7%) were HIV antibody seropositive and were thus not eligible to continue the study. The remaining 218 HIV antibody negative MSM were included in the 12-month follow-up cohort, in which 122 (56.0%) participants were retained at the 12-month follow-up visit. Baseline data were collected from the 218 enrolled participants. All MSM participants who tested positive for HIV and/or syphilis were referred to treatment.

The demographic characteristics of the cohort are described in Table 1. The median age of the cohort was 27 years old with a range from 18 to 60 years old. The majority of participants were Shenyang local residents (84.9%), had at least a high school education (66.0%) and were single (76.1%), but 19.7% were married, and 4.1% were divorced.

Drug Use and Sexual Behaviors of MSM Participants

Table 1 also highlights participant drug use and sexual behaviors. At the baseline, 136 (62.4%) reported alcohol consumption and 6 (2.8%) had a history of illegal drug use. Of those who had used illegal drugs, 5 reported ketamine use, 6 ecstasy use, and 4 amphetamine use. No one reported injection drug use.

Participants reported having a median of 5 male sexual partners in the past 12 months and 209 (95.9%) baseline participants had regular male sexual partners. About 83 (38.1%) participants had regular female sexual partners, of which 72 (86.7%) also had regular male sexual partners. About 43 (19.7%) had multiple female sexual partners. About 68.3% (136/199) of MSM participants seldom or never used condoms with their regular male sexual partners and 42.2% (35/83) seldom or never used condoms with their regular female sexual partners. A total of 205 participants had male casual sexual partners within the past 12 months and 95 (46.3%) of them reported inconsistent condom use (never or occasionally used condoms) with their male casual sexual partners. In the past 12 months, 175 (85.3%) participants had at least one male commercial sexual experience (exchanging sex for money or vice versa) and 102 (58.3%) of them reported inconsistent condom use during these sexual encounters. Within the previous 6 months, 101 (46.3%) MSM had unprotected receptive anal sex, 112 (51.4%) had unprotected insertive anal sex, 108 (49.5%) performed unprotected oral sex, and 110 (50.5%) received unprotected oral sex, all with male partners.

MSM Cohort and Those Lost to Follow-up

Compared to those who were lost to follow-up, those who were retained in the 12-month cohort were older ($P = 0.001$), had a higher proportion of married or divorced individuals ($P = 0.001$), and had a higher proportion of MSM who reported previous sexual experience with a male commercial sexual partner ($P = 0.015$). Those who were retained in the cohort had a lower baseline syphilis prevalence ($P = 0.004$) and fewer of these participants reported more than 5 male sexual partners within the past 12 months ($P = 0.009$). Other characteristics had no statistical difference between the 2 populations ($P > 0.05$) (Table 2).

HIV Incidence and HIV Seroconversion-Related Risk Factors

In the 12 months before follow-up, 6 (4.9%) MSM became HIV-positive, of whom 83.3% (5/6) were HIV/syphilis coinfected. The HIV incidence density was calculated to be 5.4/100 (95% CI: 2.0–11.3)/PY.

Table 3 illustrates the HIV-related risk factors found in univariate and multivariate regression analysis, respectively. In multivariate analysis, having syphilis infection (aOR: 11.4, 95% CI: 1.2–104.7) and having more than 5 male sexual partners in the past 12 months (aOR 6.5, 95% CI 1.1–39.8) were found to be significantly associated with HIV seroconversion.

Syphilis Prevalence/Incidence and Syphilis Seroconversion-Related Risk Factors

The prevalence of syphilis of the 122 retained MSM increased from 25.4% (31/122) at baseline to 31.1% (38/122) at follow-up. Of the 38 participants who were syphilis positive at follow-up, 5 (13.2%) were also HIV-positive. Co-infection rate of HIV and syphilis was 4.1% among the 122 retained MSM cohort.

Of the 91, 28 (30.8%) MSM who initially tested negative for syphilis (83 RPR and TPPA negative, 8 RPR negative only) at baseline seroconverted and tested positive (RPR and TPPA positive) at 12-month follow-up. Of the 83, 2 who tested RPR and TPPA negative at baseline tested RPR negative and TPPA positive at follow-up. Of the participants, 21 who were syphilis positive (RPR positive) at the baseline were found syphilis negative (RPR negative) at the 12-month follow-up. The syphilis incidence density was calculated to be 38.5 (95% CI: 27.7–50.2)/100 PY.

Table 4 shows the risk factors for syphilis seroconversion found in univariate and multivariate regression after controlling for syphilis at baseline. In univariate analysis, MSM above 30 years old were more likely to seroconvert for syphilis (OR: 3.1, 95% CI: 2.1–9.2). Along with older age, being married (OR: 3.0, 95% CI: 1.6–8.2), having more than 5 male sexual partners within the past 12 months (OR: 5.1, 95% CI: 1.6–8.2), and having receptive anal sex within the past 6 months (OR: 2.8, 95% CI: 1.4–5.8) were all identified as risk factors for syphilis seroconversion in univariate analysis. All significant risk factors identified in univariate analysis were also significant in multivariate analysis except for older age and unprotected receptive anal sex within the past 6 months, which were both found to be only marginally significant in multivariate regression ($0.05 < P < 0.1$).

DISCUSSION

This study was one of the first to find HIV and syphilis incidence and describe the associated risk-factors in Northeast China. Understanding this population is important to work toward preventing and controlling China's HIV/AIDS epidemic, as MSM may act as a potential bridge of infection to the general population in China.

During the course of the study, 6 individuals became HIV seropositive, yielding an incidence rate of 5.4/100 (95% CI: 2.0–11.3) PY. This HIV incidence rate is significantly higher than the incidence rates found in Beijing MSM (2.9/100 PY)^{18,20} and Jiangsu MSM, (5.12/100 PY)¹⁹ and higher than the rates found by other researchers in Western MSM.^{7,20–22} The results of this study suggest that Shenyang MSM may be at higher risk for HIV infection compared with other communities of MSM. Significantly, the HIV prevalence in Shenyang MSM increased from 1.0% in 2004 to 5.7% in 2008 in our cohort.¹² Without immediate intervention, HIV-prevalence among this population of Shenyang MSM may continue to increase. We also found that having more than 5 sexual partners within the past 12 months and being syphilis seropositive were both risk factors for HIV seroconversion. Relatively high HIV prevalence may contribute to the increased seroconversion in men who have more male sexual partners as they expose themselves to more risk. As mentioned, syphilis has significant implications for HIV risk. Syphilis not only indicates sexual risk behaviors, but

also may act as a cofactor for HIV seroconversion^{9–11} and those who are syphilis positive are therefore more likely to contract HIV.

Our results also indicate that syphilis incidence (38.5/100 PY) and prevalence (25.4% and 31.1% at baseline and follow-up, respectively) are alarmingly high within this population of Shenyang MSM. This is somewhat higher than the incidence found in Beijing MSM (16.9/100 PY).¹⁸ At baseline, nearly 30% of MSM tested were found to be syphilis positive and nearly 1 in 3 of the MSM who were retained in the cohort and were syphilis negative at baseline became syphilis seropositive during the course of the study. The syphilis prevalence rate of this population of Shenyang MSM is higher than the corresponding rates found in a population of Shenyang MSM in 2004 (20.4%), higher than those found in other studies in MSM in Beijing (11.2% and 19.8%),^{11,18} Jiangsu Province (6.9%),²³ Guangzhou (10.5%),²⁴ and is almost 3 times the average prevalence found in China MSM (9.1%)¹¹ overall. Thus, syphilis may also be of particular concern in Shenyang MSM as the epidemic may be larger than that in MSM in other Chinese cities and may be growing.

Furthermore, because of the biological and behavioral links between syphilis and HIV, syphilis and its associated risk factors are important indicators that will help researchers and policy-makers better understand the dynamics of syphilis and HIV risk in Chinese MSM. Multivariate analysis found that older MSM (>30 years of age) had marginally significant higher syphilis incidence when compared to younger MSM (<30 years of age) ($P = 0.07$). This finding is consistent with previous studies that have found older MSM to be more at risk^{11,25,26} for syphilis and is also supported by previous studies that have suggested that there may be a bimodal peak of syphilis, with one of the peaks among older individuals.²⁷ As social norms in China change, MSM of different generations have different opinions on sexuality and behavior and our finding of differing risk suggests that interventions should be tailored toward different age groups of MSM. Participants who reported having more than 5 male sexual partners within the past 12 months were 4.7 times more likely to become syphilis positive and those who had reported unprotected receptive anal sexual behavior were 2.4 times more likely to seroconvert.

Significantly, married participants were 3.5 times more likely to become syphilis positive during the course of the study. This finding may relate to stigma that MSM face in Chinese society. Previous studies have found that stigma and homophobia in China contribute to unsafe sexual practices.^{28–30} Because married MSM may represent those MSM that more strongly feel the influences of traditional Chinese society and the pressure to marry, they may also represent a subset of MSM who practice more unsafe sex. This finding is also of concern because syphilis may act as a cofactor in HIV transmission. Furthermore, as married MSM in this study were more likely to contract syphilis, they may also be more at risk for HIV seroconversion and thus may pose a potential risk of bridging HIV to the general population through sexual contact with their wives. Future HIV and STD interventions that target MSM should address issues of marriage, stigma, and sexual risk behavior.

This prospective cohort study had significant findings, but was not without its limitations. First, only 56% of MSM participants were retained in the 12-month cohort and the HIV and syphilis incidence of the cohort may have differed with a better retention rate. Improving

retention and eliminating barriers to retention are important to better characterize the HIV and syphilis epidemics.¹⁸

Second, the MSM cohort was relatively small and because of this only 6 MSM HIV-seroconverted in the 12 months before follow-up. HIV-related risk factors identified as significant may have differed with a larger pool of participants. Furthermore, we recruited participants from Shenyang Sunny Workgroup and through participant referral and thus may have a slightly biased sample. However, due to stigma and discrimination, it is difficult to obtain a large sample that is fully representative of MSM in Shenyang. Third, this study used RPR to test syphilis, which may miss early syphilis³¹ and did not use PCR to confirm that HIV-negative tested participants had not acquired an HIV acute infection.³² Thus, our study may underestimate syphilis and HIV incidence and prevalence.

Unprotected sex is the main risk factor for both HIV and syphilis infection. However, syphilis is more infectious than HIV and tracking syphilis incidence and the associated risk factors gives better insight into the HIV-related risk behaviors.⁶ Current syphilis infection also directly increases the risk of HIV transmission.^{7,9–11} Our results indicate that working to stymie the epidemic of syphilis and HIV within Chinese MSM should be a top public health priority. Increased HIV screening at STD clinics that service MSM should be implemented, as well as developing proper interventions and modes of sexual education to address the issues impacting MSM health behavior.

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TABLE 1

Baseline Sociodemographic and Behavioral Characteristics of MSM (n = 218)

Demographic/Behavioral Characteristics	No. Baseline MSM (%, Proportion)
Age(yr)	
18–25	95 (43.6)
26–35	55 (25.2)
36–45	47 (21.6)
46–60	21 (9.6)
Education level	
Primary school	9 (4.1)
Middle school	65 (29.8)
High school	91 (41.7)
College and above	53 (24.3)
Marital status	
Single	166 (76.1)
Married	43 (19.7)
Divorced	9 (4.1)
Illegal drug use history	6 (2.8)
Alcohol use history	136 (62.4)
Had male regular sexual partner in past 12 mo	209 (95.9)
Had female regular sexual partner in past 12 mo	83 (38.1)
Had >5 male sexual partners in past 12 mo	77 (35.3)
Had male commercial sexual partner in past 12 mo	175 (85.3)
Inconsistent condom use with male commercial sexual partner	102 (58.3)
Inconsistent condom use with regular male sexual partner	136 (68.3)
Inconsistent condom use with regular female sexual partner	35 (42.2)
Had male casual sexual partner in past 12 mo	205 (94.0)
Inconsistent condom use with male casual sexual partner	95 (46.3)
Unprotected receptive anal sex in past 6 mo	101 (46.3)
Unprotected insertive anal sex with a man in past 6 mo	112 (51.4)
Performed unprotected oral sex on a man in past 6 mo	108 (49.5)
Received unprotected oral sex from a man in past 6 mo	110 (50.5)
Prevalence of syphilis	73 (33.4)

TABLE 2

Characteristics Comparison Between Retained MSM Cohort and Those Lost to Follow-up

Demographic/Behavioral Characteristics	Number Returned MSM, N = 122 (% , Proportion)	Number Dropped Cohort MSM N = 96 (% , Proportion)	χ^2	P
Age(yr)	32.5 $\pm$ 9.7 *	28.0 $\pm$ 9.5	4.521	0.001
Schooling education			3.094	0.377
Primary school	6 (4.9)	3 (3.1)		
Middle school	32 (26.2)	33 (34.4)		
High school	50 (41.0)	41 (42.7)		
College and above	34 (27.9)	19 (19.8)		
Marital status			14.190	0.001
Single	82 (67.2)	84 (87.5)		
Married	35 (28.7)	8 (8.3)		
Divorced	5 (4.1)	4 (4.2)		
Illegal drug use history	2 (1.6)	4 (4.2)	1.282	0.258
Alcohol use history	79 (64.8)	57 (59.4)	0.663	0.416
Had male regular sexual partner in past 12 mo	118 (96.7)	91 (94.8)	0.505	0.477
Had female regular sexual partner in past 12 mo	45 (36.9)	38 (39.6)	0.166	0.684
Had >5 male sexual partners in past 12 mo	34 (27.9)	43 (44.8)	6.735	0.009
Had male commercial sexual partner in past 12 mo	105 (86.1)	70 (72.9)	5.866	0.015
Inconsistent condom use with commercial sexual partner	66 (54.1)	36 (37.5)	5.945	0.015
Inconsistent condom use with regular male sexual partner	80 (65.6)	56 (58.3)	1.200	0.273
Inconsistent condom use with regular female sexual partner	22 (18.0)	13 (13.5)	0.804	0.370
Had casual male sexual partner in past 12 mo	114 (93.4)	91 (94.8)	0.174	0.676
Inconsistent condom use with casual male sexual partner	50 (41.0)	45 (46.9)	0.758	0.384
Unprotected receptive anal sex in past 6 mo	55 (45.1)	46 (47.9)	0.174	0.677
Unprotected insertive anal sex with a man in past 6 mo	69 (56.6)	43 (44.8)	2.977	0.084
Performed unprotected oral sex on a man in past 6 mo	66 (54.1)	42 (43.8)	2.302	0.129
Received unprotected oral sex from a man in past 6 mo	66 (54.1)	44 (45.8)	1.468	0.226
Prevalence of syphilis	31 (25.4)	42 (43.8)	8.113	0.004

* Independent *t* test.

TABLE 3
HIV-1 Seroconversion-Associated Risk Factors in MSM Cohort by Logistic Regression Analyses

Factors	No. MSM	Seroconversion (Rate, %)	OR (95% CI)	P	aOR (95% CI)	P
Age (yr)			2.6 (0.5–15.0)	0.257	—	—
30	54	4 (7.4)				
>30	68	2 (2.9)				
Education level			6.4 (0.4–116.1)	0.091	—	—
Less than high school	84	6 (8.8)				
At least high school	38	0 (0.0)				
Marital status			1.3 (0.2–7.2)	0.796	—	—
Married	35	2 (5.7)				
Other	87	4 (4.6)				
Drinks alcohol A			2.8 (0.3–25.1)	0.329	—	—
Yes	79	5 (6.3)				
No	43	1 (2.3)				
Currently lives with male sexual partner			0.9 (0.1–7.7)	0.888	—	—
Yes	23	1 (4.3)				
No	99	5 (5.1)				
Currently lives with female sexual partner			0.5 (0.0–8.7)	0.331	—	—
Yes	16	0 (0.0)				
No	106	6 (5.7)				
No. male sexual partners in past 12 mo			5.7 (1.1–32.9)	0.030	6.5 (1.1–39.8)	0.04
>5	34	4 (14.3)				
5	88	2 (1.1)				
Had female sexual partner(s) in past 12 mo			0.6 (0.1–3.6)	0.608	—	—
Yes	53	2 (3.8)				
No	69	4 (5.8)				
Had male commercial sexual partner(s) in past 12 mo			2.3 (0.1–42.4)	0.312	—	—
Yes	105	6 (5.7)				
No	17	0 (0.0)				
Inconsistent condom use with regular male sexual partner			0.4 (0.1–2.1)	0.252	—	—

Factors	No. MSM	Seroconversion (Rate, %)	OR (95% CI)	P	aOR (95% CI)	P
Yes	66	2 (3.0)				
No	52	4 (7.7)				
Inconsistent condom use with regular female sexual partner			3.4 (0.3–36.2)	0.274	—	—
Yes	22	3 (2.0)				
No	23	1 (8.6)				
Inconsistent condom use with commercial sexual partner(s)			4.3 (0.5–38.5)	0.154	—	—
Yes	58	5 (8.6)				
No	47	1 (2.1)				
Unprotected receptive anal sex in past 6 mo			6.4 (0.7–56.5)	0.053	—	—
Yes	55	5 (9.1)				
No	67	1 (1.5)				
Unprotected receptive oral sex in past 6 mo			0.4 (0.1–2.3)	0.295	—	—
Yes	66	2 (3.0)				
No	56	4 (7.1)				
Unprotected insertive anal sex in past 6 mo			0.1 (0.0–1.1)	0.007	—	—
Yes	69	0 (0.0)				
No	53	6 (11.3)				
Unprotected insertive oral sex in past 6 mo			0.1 (0.0–1.2)	0.010	—	—
Yes	66	0 (0.0)				
No	56	6 (10.7)				
Baseline syphilis infection			9.9 (1.1–87.4)	0.013	11.4 (1.2–104.7)	0.03
Yes	44	5 (11.4)				
No	78	1 (1.3)				
Drug using behaviors			0.2 (0.0–6.5)	0.746	—	—
Yes	2	0 (0.0)				
No	120	6 (5.0)				

* OR indicates odds ratio; aOR, adjusted odds ratio.

TABLE 4

Risk Factors for Syphilis Seroconversion at 12 Month Follow-up Visit by Logistic Regression Analysis*

Risk Factor	Seroconversion		OR (95% CI)	P	aOR (95% CI)	P
	No. MSM	(Rate, %)				
Age (yr)			3.1 (2.1–9.2)	0.002	2.1 (0.7–9.5)	0.07
>30	68	31 (45.6)				
30	54	7 (13.0)				
Education level			1.9 (0.8–4.2)	0.16	—	—
Less than high school	38	15 (39.5)				
At least high school	84	23 (26.4)				
Marital status			3.0 (1.6–8.2)	0.002	3.5 (1.4–8.2)	0.03
Married	35	20 (57.1)				
Other	87	18 (20.7)				
Drinks alcohol			1.2 (0.4–5.3)	0.32	—	—
Yes	79	27 (34.2)				
No	43	11 (25.6)				
Currently lives with male sexual partner			1.1 (0.3–2.2)	0.47	—	—
Yes	23	8 (34.8)				
No	99	30 (30.3)				
Currently lives with female sexual partner			2.0 (0.7–3.5)	0.23	—	—
Yes	16	10 (62.5)				
No	106	28 (26.4)				
No. male sexual partners in past 12 mo			5.1 (1.6–8.2)	0.003	4.7 (2.0–6.2)	0.008
5	34	24 (70.6)				
5	88	14 (15.9)				
Had female sexual partner(s) in past 12 mo			1.3 (0.4–3.6)	0.22	—	—
Yes	53	20 (27.7)				
No	69	18 (26.1)				
Had male commercial sexual partner(s) in past 12 mo			1.1 (0.4–2.9)	0.59	—	—
Yes	105	33 (31.4)				
No	17	5 (29.4)				
Inconsistent condom use with regular male sexual partner			1.3 (0.5–2.7)	0.58	—	—

Risk Factor	No. MSM	Seroconversion (Rate, %)	OR (95% CI)	P	aOR (95% CI)	P
Yes	66	25 (37.9)				
No	52	10 (19.2)				
Inconsistent condom use with regular female sexual partner			1.6 (0.4–4.3)	0.24	—	—
Yes	22	12 (54.5)				
No	23	7 (30.4)				
Inconsistent condom use with male casual sexual partner			1.1 (0.5–2.9)	0.76	—	—
Yes	51	20 (39.2)				
No	58	15 (25.9)				
Inconsistent condom use with commercial sexual partner(s)			1.8 (0.6–3.9)	0.16	—	—
Yes	58	22 (37.9)				
No	47	6 (12.8)				
Unprotected receptive anal sex in past 6 mo			2.8 (1.4–5.8)	0.01	—	—
Yes	55	28 (50.9)				
No	67	10 (14.9)				
Unprotected receptive oral sex in past 6 mo			1.8 (0.5–4.7)	0.33	2.4 (0.7–13.1)	0.08
Yes	66	19 (38.0)				
No	56	19 (26.4)				
Unprotected insertive anal sex in past 6 mo			1.2 (0.4–5.4)	0.24	—	—
Yes	69	25 (36.2)				
No	53	13 (24.5)				
Unprotected insertive oral sex in past 6 mo			1.1 (0.5–2.4)	0.81	—	—
Yes	66	22 (33.3)				
No	56	16 (28.6)				
Drug using behaviors			0.2 (0.1–8.4)	0.94	—	—
Yes	2	0 (0.0)				
No	120	38 (31.7)				

* After controlling for syphilis at baseline.