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## HIV Testing and sexual risks among migrant men who have sex with men: Findings from a large cross-sectional study in Beijing, China

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### Abstract

Despite the increasing population size and exacerbating HIV/STD transmission dynamics among migrant men who have sex with men (MSM) in China, few epidemiological studies specifically explore the determinants of their high-risk profiles. This study aimed to 1) compare the sociodemographic/behavioral characteristics between migrant and local resident MSM, and 2) investigate the correlates of HIV or syphilis infection, and experience of prior HIV testing among migrant MSM in Beijing, China. A cross-sectional survey of sociodemographic characteristics and HIV-related behaviors was conducted among 3,588 HIV-negative or status-known MSM. Participants were recruited via short message services, peer referral, website advertisement, community outreach and self-participation. HIV and syphilis infection status were lab-confirmed. The HIV and syphilis prevalence among migrant MSM were 14.7% and 8.0%, respectively. Migrant MSM were more likely to be HIV-infected compared to local MSM (14.7% vs. 7.4%; aOR, 2.02; 95% CI, 1.52–2.68). Among 2,699 migrant MSM, increased likelihood of ever testing for HIV was associated with older age, living longer in Beijing, having 10 lifetime male sexual

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partners, having insertive anal sex; while being unemployed/retired and having condomless receptive anal sex were associated with a lower odds of ever testing for HIV. Being married, living longer in Beijing, ever testing for HIV and having sex with women were associated with lower likelihood of HIV; while being unemployed/retired, having higher HIV perception, having 10 lifetime male sexual partners and having condomless receptive anal sex were associated a higher HIV odds. Increased likelihood of syphilis was associated with older age, being employed, higher HIV perception, having 10 lifetime male sexual partners and having receptive anal sex. Migrant MSM present unique challenge to the HIV/syphilis epidemics and access to HIV care services. Our study provides implications for targeted interventions to tackle HIV/STI risks and improve HIV testing uptake among migrant MSM in China.

### Keywords

HIV; syphilis; HIV testing; migrant; men who have sex with men; China

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### Introduction

China's "Reform and Opening-up" policy has propelled the nation's unprecedented urbanization and industrialization, accompanied by massive internal migration from both rural and urban regions to major metropolitan cities for better employment opportunities and living conditions (Sun, Chen, & Chan, 2016). These migrants usually do not have legal household registration (*Hukou*) in their new locales (Liang, Li, & Ma, 2014).

Internal migration may also influence the epidemic of HIV/AIDS and sexually transmitted infections (STI) in China (L. Zhang, Chow, Jahn, Kraemer, & Wilson, 2013). First, migrants (especially rural-to-urban migrants) are living far from their homes where traditional social values might be extant. Thus, they are more likely to be influenced by the comparatively open sexual norms in large cities (X. Yang, Derlega, & Luo, 2007), and inclined to engage in risky behaviors (e.g., multiple partnerships, condomless sex, substance use)(X. S. Chen, Peeling, Yin, & Mabey, 2011; W. Wang et al., 2010). Second, compared to local residents, migrants may be less educated and limited in HIV prevention knowledge (W. Wang, Muessig, Li, & Zhang, 2014; X. Y. Yang, Kelly, & Yang, 2015). They are further disadvantaged by *Hukou* restriction on full access to government-supported benefit programs, including HIV services (Zeng, Shi, Zou, Chen, & Ling, 2015). Third, evidence suggests that migrants who have ever engaged in unprotected sex (with commercial sex worker, etc. ) while working away from home might unwittingly infect their spouse after visiting/returning to their hometowns for holidays, potentially driving the HIV epidemics among general population (Huang et al., 2014).

Men who have sex with men (MSM) continues to be the high-risk subgroup for contracting and transmitting HIV/STI in China. Several studies suggest that a majority of MSM in large cities are migrants (61.8%-81.3%) (Lau, Li, Wang, & Lai, 2015; D. Li et al., 2012; Liu, Ruan, et al., 2015; Qian et al., 2015). Compared to non-migrant MSM, migrant MSM are more likely to have a dynamic sexual network and engage in risky behaviors (Liu et al., 2012; Song et al., 2011). While many studies have individually researched on HIV

transmission and prevention intervention among MSM, or among migrant population, evidence remains scarce among migrant Chinese MSM. The current study intends to bridge this research gap using a large sample of community-based MSM to (1) compare socioeconomic and behavioral characteristics between migrant and non-migrant MSM, and (2) assess correlates of HIV/syphilis infection and HIV testing among migrant MSM.

## Methods

### Study setting and design

The current study was based on the baseline data of a randomized clinical trial (Multi-component HIV Intervention Packages for Chinese MSM —Test, Link and Care). Details of the study design and setting of the parent trial have been described in previously published studies (Liu, Qian, et al., 2016). In short, we collaborated with a local gay-friendly community-based organization (CBO; Chaoyang AIDS Volunteer Group) to recruit a convenience sample of MSM via website advertisement, short message service, gay-frequented venues outreach and peer referral. Men were considered eligible for study participation if they who were currently living in Beijing and not planning to leave in the next 12 months, 18 years old, self-reporting as HIV-negative or status unknown, having sex with another man in the past 12 months, and willing to provide written informed consent. Eligible/interested participants further completed a survey at one of our participated HIV clinics/hospitals and have their blood drawn for HIV and syphilis test. The study protocol was approved by the Institutional Review Boards of Vanderbilt University and the National Center for AIDS/STD Control and Prevention (NCAIDS) of Chinese Center for Disease Control and Prevention.

### Data collection

We used interviewer-administered questionnaire survey to collect data on (1) socio-demographic characteristics, e.g., age, ethnicity, marital status, education, employment, income, *Hukou*, duration of living in Beijing, and health insurance status; (2) high risk behaviors, e.g., recent (past 3 months) alcohol consumption, recent alcohol use before sex, recent illicit drug use, recent insertive/receptive anal sex patterns with men, recent sex with women, recent experience with male commercial sex workers, recent sex with HIV-positive men, lifetime number of male or female sex partners and self-reported HIV risk perception. Although there are different practices in defining migrant status in China, we used the conventional criteria—*Hukou* status, to determine migrant vs. local resident status in our study. Participants who did not have *Hukou* at the time of the survey were categorized as migrants, regardless of the duration of living in the city (Liu et al., 2012; Mao et al., 2014). After survey completion, participants were asked to undertake a rapid HIV (Alere Determine HIV1/2; Colloidal Selenium Device; Alere Medical Co, Ltd., USA) and syphilis (Toluidine red unheated serum test; Wantai Biological Pharmacy Enterprise Co., Ltd., Beijing, China) tests. If positive in the rapid tests, a 5-mL specimen would be drawn from the participants to perform laboratory confirmatory HIV (HIV ELISA testing kit; Zhuhai Livzon Diagnostics Inc., China) and syphilis (Tre-ponemapallidum particle assay; Fujirebio, Inc., Tokyo, Japan) tests. Details of the laboratory testing techniques are described elsewhere (H. Zhang et al., 2016).

## Statistical analysis

We compared sociodemographic characteristics and high-risk behaviors between migrant and non-migrant MSM using Pearson Chi-square tests. To explore potential sociodemographic or behavioral factors that might be associated with HIV testing and HIV or syphilis infection, we used Chi-square tests to initially assess the significance of their associations (Table 1) with each of the three outcomes. Significant correlates ( $p < 0.05$ ) were selected for multivariable logistic regression analyses in separate multivariable model for each outcome of interest (HIV infection, syphilis infection or HIV testing), respectively. In multivariable analyses, correlates (Table 2–4) were entered into each model for a given outcome (HIV testing, HIV infection or syphilis infection), followed by a manual stepwise backward selection procedure to only retain significant sets ( $p < 0.05$ ) in each final multivariable model (Liu, Ruan, et al., 2015). Collinearity was assessed before fitting the final regression models. We analyzed data using Stata 12.0™ (StataCorp LP, College Station, Texas, USA).

## Results

### Sample description of all MSM

Among 3,588 participants, 75.2% (2,699/3,588) were migrants. Of the 2,699 migrant MSM, 61.0% were younger than 30 years old, 63.5% lived in Beijing for <5 years, 93.5% were Han, 84.3% were single (not married to a woman), 66.9% had at least a college education, 84.8% were employed, 52.1% were health-insured. Of these migrants, HIV prevalence was 14.4% (vs. 7.4% among local residents) syphilis prevalence was 8.0% (vs. 6.1% among local residents) and HIV testing rate was 70.4% (vs. 71.3% among local residents) (Table 1).

### Comparison between migrant and non-migrant MSM

Compared to local resident MSM, migrant MSM were more likely to be younger (age < 30, 61.0% vs. 50.7%;  $p < 0.001$ ), employed (84.8% vs. 75.4%;  $p < 0.001$ ), recent alcohol use before sex (22.1% vs. 15.9%;  $p < 0.001$ ), have recent insertive (61.6% vs. 57.5%;  $p = 0.03$ ) or receptive (53.1% vs. 49.7%;  $p = 0.04$ ) anal sex with men, have recent sex (11.2% vs. 8.4%;  $p = 0.02$ ) or condomless sex (7.2% vs. 4.8%;  $p = 0.01$ ) with women, be HIV-positive (14.4% vs. 7.4%;  $p < 0.001$ ) and HIV/syphilis co-infected (2.5% vs. 0.7%;  $p = 0.001$ ). Migrant MSM were less likely to live in Beijing for a longer duration (e.g., >5 years, 36.5% vs. 84.7%;  $p < 0.001$ ), have college education (66.9% vs. 87.0%;  $p < 0.001$ ), have higher monthly income (e.g., 5000 yuan, 51.1% vs. 57.5%;  $p = 0.001$ ) and be health insured (52.1% vs. 88.6%;  $p < 0.001$ ; Table 1).

### Association of migration status with prior HIV testing and HIV/syphilis risk

Table 2 shows the association of migration status with prior testing, HIV and syphilis risk. After adjusting for age, education, employment, ethnicity and marital status, migrant MSM were more likely to be HIV-infected than local MSM (adjusted odds ratio [aOR], 2.02; 95% confidence interval [CI], 1.52–2.68). There was no statistically significant association between migration status and prior HIV testing or syphilis infection.

### Correlates of HIV testing among migrant MSM

Table 3 shows of the multivariable-adjusted factors associated with HIV testing among migrant MSM. A higher likelihood of ever testing for HIV was associated with ages  $\geq 30$  years (aOR, 1.54, 95% CI, 1.30–1.94), living longer in Beijing (e.g.,  $>10$  years, aOR, 1.95; 95% CI, 1.31–2.91),  $\geq 10$  lifetime male sexual partners (aOR, 2.76; 95% CI, 2.30–3.31), and recent insertive anal sex with men (aOR, 1.27; 95% CI, 1.07–1.52). In contrast, a lower likelihood of ever testing for HIV was associated with being unemployed/retired (aOR, 0.68; 95% CI, 0.46–0.99) and recent condomless receptive anal sex with men (aOR, 0.81; 95% CI, 0.66–0.99).

### Correlates of HIV or syphilis infection among migrant MSM

Table 4 shows the factors associated with HIV or syphilis infection among migrant MSM. A lower likelihood of being HIV-infected was associated with being currently married (aOR, 0.60; 95% CI, 0.41–0.87), living longer in Beijing (e.g.,  $>10$  year, aOR, 0.58; 95% CI, 0.37–0.90), ever testing for HIV (aOR, 0.65; 95% CI, 0.51–0.83) and having recent sex with women. In contrast, a higher likelihood of being HIV-infected was seen among those who were unemployed/retired (aOR, 1.70; 95% CI, 1.10–2.61), self-perceiving of likely/very likely being HIV-infected (aOR, 4.00; 95% CI, 3.13–5.11), having  $\geq 10$  lifetime male sexual partners (aOR, 1.32; 95% CI, 1.04–1.68), and having recent receptive (aOR, 1.53; 95% CI, 1.16–2.01) or condomless receptive anal sex (aOR, 1.34; 95% CI, 1.01–1.78) with men. A higher likelihood of being syphilis-infected was seen among migrant MSM were  $\geq 30$  years old (aOR, 1.38; 95% CI, 1.02–1.88), unemployed/retired (aOR, 1.91; 95% CI, 1.15–3.17), self-perceiving of being likely/very likely to be HIV-infected (aOR, 1.58; 95% CI, 1.18–2.11), reporting  $\geq 10$  lifetime male sexual partners (aOR, 2.02; 95% CI, 1.49–2.75) and reporting recent receptive anal sex with men (aOR, 1.38; 95% CI, 1.03–1.85).

## Discussion

In this study, we found migrant MSM were twice more likely to be HIV-infected compared to local resident MSM, supporting findings from previous Chinese studies (Mao et al., 2014; B. Wang, Li, Stanton, Liu, & Jiang, 2013). The dissimilarities in sociodemographic and behavioral characteristics between migrant and local resident MSM may account for differential HIV risks. Consistent with other studies (Mao et al., 2014; Song et al., 2011; B. Wang et al., 2013), we found migrant MSM were more likely to be younger, less-educated, have lower income and not being health-insured. Young MSM are also at elevated per-contact risk for unprotected anal sex with HIV seropositive partners (Scott et al., 2014). Young age among migrant MSM might signify early sexual debut. Some studies suggest that MSM who practice first sex at a younger age are more likely to encounter emotional/mental distress, which is a plausible psychological precursor of subsequent risky behaviors, such as increased number of sexual partners, practice of unprotected sex and substance abuse (Liu et al., 2017; Outlaw et al., 2011). Migrant MSM were significantly less likely to be college-educated than local resident MSM in our study. Lower education attainment, unemployment and financial hardship might reflect disadvantaged SES, the usual motive for migration. Other studies note that low SES is associated with increased HIV risk, including inadequate HIV knowledge/awareness and cost barriers for condom use and preventative services (Bai

et al., 2011; Liu et al., 2012). We observed higher employment percentage among migrant MSM in our study, however, we cannot delineate their specific job categories that may tie to certain social/financial benefit, and how this might influence on their overall SES. Future studies with a more refined assessment are needed to address research question of such nature. Given the higher proportion of male migrants than female migrants in China, this immense pool of migratory men, especially MSM subgroups with various HIV/STI risks must be considered for targeted risk reduction interventions.

In this study, 70.4% of migrant MSM had ever tested for HIV, similar to that among local resident MSM (71.3%). We speculate several explanations to our observation. First, the implementation of “Free Voluntary HIV Counseling and Testing” policy by the government and collaboration with CBOs has enhanced HIV testing availability and accessibility, especially in major Chinese cities (Dou et al., 2015). Second, a substantial increase of domestically and internationally funded prevention intervention projects in China during recent years may have exposed all MSM subgroups to compensated HIV testing opportunities. Third, the increasing popularity and influence of social media in promulgating accommodating social/cultural norms towards homosexuality and HIV might help alleviate stigma, which facilitates HIV testing uptakes. Nonetheless, qualitative studies have shown that migrant MSM are still less inclined to test for HIV, simply due to low HIV risk knowledge/perception and restriction by their *Hukou* status (Liu, Sun, et al., 2015; Wei et al., 2014). The counseling that accompanies the regular testing may convey HIV prevention knowledge, suggesting a possible pathway that frequent testers may be intervened with enhanced HIV awareness to lower their HIV risk behaviors (Straub et al., 2011). Thus, expanding HIV testing/counseling sites and risk reduction programs around migrant MSM frequented venues is needed to increase their access to HIV testing and counselling services.

Our analyses of sociodemographic and behavioral correlates of HIV/syphilis infection and HIV testing among migrant MSM revealed elements with important prevention implications. Marrying can act to both blunt and exacerbate different elements of HIV transmission dynamics between MSM and the general population. However, quantitative evidence regarding the effect of marriage on HIV acquisition remained inconsistent (G. Chen et al., 2012). While an earlier study found being married to a woman was a significant risk factor for HIV among Chinese MSM (B. Wang et al., 2013), we found married MSM were more likely to ever test for HIV and less likely to be HIV-infected, which was in line with a study among Chinese MSM in Jinan, Shandong Province (Ruan et al., 2009). A qualitative also suggests that married MSM may feel obligated to protect their wives and families by reducing high risk behaviors and test more frequently for HIV (Liu, Sun, et al., 2015). This suggests the feasibility of enhancing the willingness and heightening the sense of responsibility to protect their wives/families/partners among both migrant and non-migrant MSM (Liu, Li, et al., 2016).

We also found migrant MSM who lived in Beijing for a shorter duration were less likely to test for HIV and more likely to be HIV-infected. In this study, nearly 64% of migrant MSM lived in Beijing for fewer than 5 years. And as expected, we found a positive correlation between age and years of living in Beijing among migrant MSM (e.g., median age of migrant MSM living in Beijing for 2 years was 25 years vs. median age of migrant MSM

living in Beijing for >10 years was 36,  $p < 0.001$ ; data not shown). These recent migrant MSM may reflect the risk profile of young migrants who are more sexually active and have dynamic sexual networks, resulting in increased HIV/STI risk. Evidence also suggests that shorter duration of dwelling in a city is correlated with lower HIV testing uptake, which is a plausible indicator of increased HIV risk (X. Li et al., 2014). It is likely new migrants in big cities are more attracted to increased venues of seeking sexual partners compared to their hometowns, in the meantime, are less aware of testing opportunity and less exposed to HIV risk reduction programs (Wei et al., 2014). Many MSM in China are closely connected to gay-friendly community-based organizations (CBOs) with accommodating peer staff and dedication to addressing the social/medical needs of MSM (Tucker et al., 2014). Future research should incorporate local gay-focused CBOs to target recent migrant MSM for nesting research within a strong prevention outreach context.

The strengths of our study included a substantial sample size and high degree of participation among MSM from many backgrounds and venues in Beijing. Limitations are also extant. First, our study was limited to MSM in Beijing whose characteristics may differ from men in other cities. Second, the self-report and culturally sensitive nature of prior sexual behavior data may be subjected to recall and social desirability bias. Third, our cross-sectional study cannot elucidate the temporal relationship between the correlates and the outcomes, limiting inferences as to the long-term effect of migration on sexual risk. Fourth, as a secondary data analysis, we were limited to further explore certain migratory patterns in relation to HIV transmission dynamics among this population (e.g. frequency or length of home visiting and risky behaviors occurred at both destinations).

This study is among the very few to comprehensively assess correlates of HIV/syphilis risk and HIV testing among migrant Chinese MSM and provide implications for future prevention interventions. Our findings revealed that, compared to local resident MSM, migrant MSM are more likely to demonstrate a dynamic high-risk profile by engaging in risky sexual behaviors due to their migrant vulnerabilities and socioeconomic features, which increase their risk of acquiring and transmitting HIV/STI. *Hukou* constraints and limited knowledge of resource availability of the new locale may impede their access, linkage to and engagement in HIV care services. However, more in-depth studies are needed to substantiate our speculations. Future interventions and policy establishment should focus on accommodating personal, structural and cultural needs of migrant MSM to enhance their linkage to HIV-related services.

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**Table 1**

Sociodemographic characteristics and HIV high-risk behaviors among a community-based sample of 3,588 local and migrant men who have sex with men (MSM) in Beijing, China

Variable	Total N=3,588	Migration status		P-value
		Migrants N=2,699	Local residents N=899	
<b>Age, year</b>				<b>&lt;0.001</b>
<30	2,097 (58.4)	1,646 (61.0)	451 (50.7)	
30	1,491 (41.6)	1,053 (39.0)	438 (49.3)	
<b>Year of living in Beijing</b>				<b>&lt;0.001</b>
2	929 (25.9)	872 (32.3)	57 (6.4)	
3–5	922 (25.7)	843 (31.2)	79 (8.9)	
6–10	877 (24.4)	732 (27.1)	145 (16.3)	
>10	860 (24.0)	252 (9.4)	608 (68.4)	
<b>Ethnicity</b>				0.41
Han	3,361 (93.7)	2,523 (93.5)	838 (94.3)	
Non-Han	227 (6.3)	176 (6.5)	51 (5.7)	
<b>Current marital status</b>				0.05
Single	3,049 (85.0)	2,275 (84.3)	774 (87.1)	
Married to a woman	539 (15.0)	424 (15.7)	115 (12.9)	
<b>Education (year of schooling)</b>				<b>&lt;0.001</b>
Junior middle school and less ( 9)	416 (11.6)	377 (14.0)	39 (4.4)	
Senior high (10–12)	593 (16.5)	516 (19.1)	77 (8.6)	
College and above (>12)	2,579 (71.9)	1,806 (66.9)	773 (87.0)	
<b>Employment</b>				<b>&lt;0.001</b>
Employed	2,960 (82.5)	2,290 (84.8)	670 (75.4)	
Unemployed/retired	182 (5.1)	135 (5.0)	47 (5.3)	
Student	388 (10.8)	226 (8.4)	162 (18.2)	
Other	58 (1.6)	48 (1.8)	10 (1.1)	
<b>Personal monthly income, Chinese yuan</b>				<b>0.001</b>
<5000	1,698 (47.3)	1,320 (48.9)	378 (42.5)	
5000	1,890 (52.7)	1,379 (51.1)	511 (57.5)	
<b>Health insurance</b>				<b>&lt;0.001</b>
No	1,395 (38.9)	1,294 (47.9)	101 (11.4)	
Yes	2,193 (61.1)	1,405 (52.1)	788 (88.6)	
<b>Perception of HIV risk</b>				0.09
Low/no risk	2,126 (59.3)	1,578 (58.5)	548 (61.6)	
Likely/very likely	1,462 (40.7)	1,121 (41.5)	341 (38.4)	
<b>Ever tested for HIV</b>				0.60
Never	1,054 (29.4)	799 (29.6)	255 (28.7)	
Ever	2,534 (70.6)	1,900 (70.4)	634 (71.3)	
<b>Number of lifetime male sexual partners</b>				0.66
<10	1,815 (50.6)	1,371 (50.8)	444 (49.9)	

Variable	Migration status			P-value
	Total N=3,588	Migrants N=2,699	Local residents N=899	
10	1,773 (49.4)	1,328 (49.2)	445 (50.1)	
<b>Alcohol consumption in the past 3 months</b>				0.44
No	1,574 (43.9)	1,174 (43.5)	400 (45.0)	
Yes	2,014 (56.1)	1,525 (56.5)	489 (55.0)	
<b>Alcohol use before sex in the past 3 months</b>				<0.001
No	2,850 (79.4)	2,102 (77.9)	748 (84.1)	
Yes	738 (20.6)	597 (22.1)	141 (15.9)	
<b>Drug use in the past 3 months</b>				0.98
No	2,600 (72.5)	1,956 (72.5)	644 (72.4)	
Yes	988 (27.5)	743 (27.5)	245 (27.6)	
<b>Had insertive anal sex with men in the past 3 months</b>				0.03
No	1,414 (39.4)	1,036 (38.4)	378 (42.5)	
Yes	2,174 (60.6)	1,663 (61.6)	511 (57.5)	
<b>Had condomless insertive anal sex with men in the past 3 months</b>				0.58
No	2,801 (78.1)	2,101 (77.8)	700 (78.7)	
Yes	787 (21.9)	598 (22.2)	189 (21.3)	
<b>Had receptive anal sex with men in the past 3 months</b>				0.04
No	1,713 (47.7)	1,266 (46.9)	447 (50.3)	
Yes	1,875 (52.3)	1,433 (53.1)	442 (49.7)	
<b>Had condomless receptive anal sex with men in the past 3 months</b>				0.13
No	2,855 (79.6)	2,132 (79.0)	723 (81.3)	
Yes	733 (20.4)	567 (21.0)	166 (18.7)	
<b>Had anal sex with HIV-positive men in the past 3 months</b>				0.77
No	3,496 (97.4)	2,631 (97.5)	865 (97.3)	
Yes	92 (2.6)	68 (2.5)	24 (2.7)	
<b>Had commercial sex with men in the past 3 months</b>				0.07
No	3,488 (97.2)	2,616 (96.9)	872 (98.1)	
Yes	100 (2.8)	83 (3.1)	17 (1.9)	
<b>Had sex with women in the past 3 months</b>				0.02
No	3,211 (89.5)	2,397 (88.8)	814 (91.6)	
Yes	377 (10.5)	302 (11.2)	75 (8.4)	
<b>Had condomless vaginal sex with women in the past 3 months</b>				0.01
No	3,351 (93.4)	2,505 (92.8)	846 (95.2)	
Yes	237 (6.6)	194 (7.2)	53 (4.8)	
<b>HIV positivity</b>				<0.001
No	3,133 (87.3)	2,310 (85.6)	823 (92.6)	
Yes	455 (12.7)	389 (14.4)	66 (7.4)	
<b>Syphilis seropositivity</b>				0.06
No	3,319 (92.5)	2,484 (92.0)	835 (93.9)	
Yes	269 (7.5)	215 (8.0)	54 (6.1)	

Variable	Migration status			P-value
	Total N=3,588	Migrants N=2,699	Local residents N=899	
<b>HIV/syphilis co-infection</b>				<b>0.001</b>
No	3,514 (97.9)	2,631 (97.5)	883 (99.3)	
Yes	74 (2.1)	68 (2.5)	6 (0.7)	

Note: IQR, interquartile range; 1 Chinese yuan=0.15 US dollar; Drug use, use of any drugs, including methamphetamine, MDMA, rush, magu, ketamine, cannabis/marijuana, cocaine, opium, or heroin, Morphine

**Table 2**

Multivariable logistic regression of the association between migration status and prior HIV testing and HIV and syphilis infections among 3,588 Beijing MSM

<b>Migration status</b>	<b>Adjusted OR (95% CI)*</b>
<i>Prior HIV testing</i>	
Local Beijing residents	Reference
Migrants	0.98 (0.82, 1.18)
<i>HIV infection</i>	
Local Beijing residents	Reference
Migrants	2.02 (1.52, 2.68)
<i>Syphilis infection</i>	
Local Beijing residents	Reference
Migrants	1.25 (0.89, 1.74)

Note: OR, odds ratio; CI, confidence interval.

\* Adjusted for demographic variables including age, education, ethnicity, employment and current marital status

**Table 3**

Multivariable logistic regression of factors associated with ever testing for HIV among 2,699 migrant MSM in Beijing, China

Variable	HIV testing		aOR (95% CI)
	Never tested (N=799)	Ever tested (N=1,900)	
<b>Age, year</b>			
<30	584 (73.1)	1,062 (55.9)	Reference
30	215 (26.9)	838 (44.1)	1.54 (1.30, 1.94)
<b>Personal monthly income Chinese yuan</b>			
<5000	436 (54.6)	884 (46.5)	NS
5000	363 (45.4)	1,016 (53.5)	
<b>Year of living in Beijing</b>			
2	334 (41.8)	538 (28.3)	Reference
3–5	253 (31.7)	590 (31.1)	1.26 (1.02, 1.56)
6–10	173 (21.6)	559 (29.4)	1.38 (1.09, 1.75)
>10	39 (4.9)	213 (11.2)	1.95 (1.31, 2.91)
<b>Employment</b>			
Employed	638 (79.8)	1,652 (87.0)	Reference
Unemployed/retired	49 (6.1)	86 (4.5)	0.68 (0.46, 0.99)
Student	102 (12.8)	124 (6.5)	
Other	10 (1.3)	38 (2.0)	
<b>Current marital status</b>			
Single	691 (86.5)	1,584 (83.4)	NS
Married to a woman	108 (13.5)	316 (16.6)	
<b>Alcohol use before sex in the past 3 months</b>			
No	650 (81.4)	1,452 (76.4)	NS
Yes	149 (18.6)	448 (23.6)	
<b>Drug use in the past 3 months</b>			
No	601 (75.2)	1,355 (71.3)	NS
Yes	198 (24.8)	545 (28.7)	
<b>Lifetime male sexual partners</b>			
<10	559 (70.0)	812 (42.7)	Reference
10	240 (30.0)	1,088 (57.3)	2.76 (2.30, 3.31)
<b>Had insertive anal sex with men in the past 3 months</b>			
No	367 (45.9)	669 (35.2)	Reference
Yes	432 (54.1)	1,231 (64.8)	1.27 (1.07, 1.52)
<b>Had condomless receptive anal sex with men in the past 3 months</b>			
No	609 (76.2)	1,523 (80.2)	Reference
Yes	190 (23.8)	377 (19.8)	0.81 (0.66, 0.99)

Note: aOR, adjusted odds ratio; CI, confidence interval; drug use, use of any drugs including methamphetamine, MDMA, rush, magu, ketamine, cannabis/marijuana, cocaine, opium, heroin, morphine

NS, not statistically significant in multivariable analysis ( $p > 0.05$ ), and were not retained in the final multivariable model after stepwise backward selection procedure

**Table 4**  
Multivariable logistic regression of factors associated with HIV and syphilis infections among 2,699 migrant MSM in Beijing, China

Variable	HIV infection		Syphilis infection		aOR (95% CI)
	HIV-positive (N=389)	HIV-negative (N=2,310)	Seropositive (N=210)	Seronegative (N=2,489)	
<b>Age, year</b>					
<30			104 (49.5)	1,542 (62.0)	Reference
30			106 (50.5)	947 (38.0)	1.38 (1.02, 1.88)
<b>Ethnicity</b>					
Han			189 (90.0)	2,334 (93.8)	NS
Non-Han			21 (10.0)	155 (6.2)	
<b>Current marital status</b>					
Single	346 (88.9)	1,929 (83.5)			Reference
Married to a woman	43 (11.1)	381 (16.5)			0.60 (0.41, 0.87)
<b>Year of living in Beijing</b>					
2	156 (40.1)	716 (31.0)			Reference
3–5	114 (29.3)	729 (31.6)			0.74 (0.56, 0.96)
6–10	88 (22.6)	644 (27.9)			0.61 (0.45, 0.83)
>10	31 (8.0)	221 (9.5)			0.58 (0.37, 0.90)
<b>Employment</b>					
Employed	323 (83.0)	1,967 (85.1)	173 (82.4)	2,117 (85.1)	Reference
Unemployed/retired	29 (7.5)	106 (4.6)	20 (9.5)	115 (4.6)	1.91 (1.15, 3.17)
Student	23 (5.9)	203 (8.8)	10 (4.8)	216 (8.7)	
Other	14 (3.6)	34 (1.5)	7 (3.3)	41 (1.6)	
<b>Education (year of schooling)</b>					
College and above (>12)	272 (69.9)	1,534 (66.4)	108 (51.4)	1,698 (68.2)	NS
Senior high (10–12)	55 (14.1)	461 (20.0)	49 (23.3)	467 (18.8)	
Junior middle school and less (<9)	62 (16.0)	315 (13.6)	53 (25.3)	324 (13.0)	
<b>Monthly income, Chinese yuan</b>					
<5000			122 (58.1)	1,198 (48.1)	NS
5000			88 (41.9)	1,291 (51.9)	
<b>Health insurance</b>					

Variable	HIV infection		Syphilis infection	
	HIV-positive (N=389)	HIV-negative (N=2,310)	Seropositive (N=210)	Seronegative (N=2,489)
No	213 (54.8)	1,081 (46.8)	135 (64.3)	1,159 (46.6)
Yes	176 (45.2)	1,229 (53.2)	75 (35.7)	1,330 (53.4)
<b>Perception of HIV risk</b>				
Low/no risk	107 (27.5)	1,471 (63.7)	98 (46.7)	1,480 (59.5)
Likely/very likely	282 (72.5)	839 (36.3)	112 (53.3)	1,009 (40.5)
<b>Ever tested for HIV</b>				
Never	144 (37.0)	655 (28.3)	Reference	NA <sup>2</sup>
Ever	245 (63.0)	1,655 (71.7)	0.65 (0.51, 0.83)	
<b>Alcohol use before sex in the past 3 months</b>				
No	283 (72.7)	1,819 (78.7)	NS	NA <sup>2</sup>
Yes	106 (27.3)	491 (21.3)		
<b>Drug use in the past 3 months</b>				
No	257 (66.1)	1,699 (73.5)	NS	NA <sup>2</sup>
Yes	132 (33.9)	611 (26.5)		
<b>Lifetime male sexual partners</b>				
<10	173 (44.5)	1,198 (51.9)	Reference	Reference
10	216 (55.5)	1,112 (48.1)	1.32 (1.04, 1.68)	2.02 (1.49, 2.75)
<b>Had receptive anal sex with men in the past 3 months</b>				
No	125 (32.1)	1,141 (49.4)	Reference	Reference
Yes	264 (67.9)	1,169 (50.6)	1.53 (1.16, 2.01)	1.38 (1.03, 1.85)
<b>Had condomless receptive sex with men in the past 3 months</b>				
No	252 (64.8)	1,880 (81.4)	Reference	NA <sup>2</sup>
Yes	137 (35.2)	430 (18.6)	1.34 (1.01, 1.78)	
<b>Had anal sex with HIV-positive men in the past 3 months</b>				
No	373 (95.9)	2,258 (97.8)	NS	NA <sup>2</sup>
Yes	16 (4.1)	52 (2.2)		
<b>Had sex with women in the past 3 months</b>				
No	366 (94.1)	2,031 (87.9)	Reference	NA <sup>2</sup>
Yes	23 (5.9)	279 (12.1)	0.58 (0.37, 0.92)	



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Note: aOR, adjusted odds ratio; CI, confidence interval

Drug use, use of any drugs, including methamphetamine, MDMA, rush, magu, ketamine, cannabis/marijuana, cocaine, opium, heroin, morphine

NS, not statistically significant in multivariable analysis ( $p>0.05$ ), and were not retained in the final multivariable model after stepwise backward selection procedure;

NA<sup>1</sup>, not selected for multivariable logistic regression analysis with HIV infection because not meeting the prespecified correlate selection criteria based on Chi square test ( $p<0.05$ )

NA<sup>2</sup>, not selected for multivariable logistic regression analysis with sypphilis infection because not meeting the prespecified correlate selection criteria based on Chi square test ( $p<0.05$ )