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A comparison of four sampling methods among men having sex with men in China: implications for HIV/STD surveillance and prevention

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Abstract

Sample representativeness remains one of the challenges in effective HIV/STD surveillance and prevention targeting MSM worldwide. Although convenience samples are widely used in studies of MSM, previous studies suggested that these samples might not be representative of the broader MSM population. This issue becomes even more critical in many developing countries where needed resources for conducting probability sampling are limited. We examined variations in HIV and Syphilis infections and sociodemographic and behavioral factors among 307 young migrant MSM recruited using four different convenience sampling methods (peer outreach, informal social network, Internet, and venue-based) in Beijing, China in 2009. The participants completed a self-administered survey and provided blood specimens for HIV/STD testing. Among the four MSM samples using different recruitment methods, rates of HIV infections were 5.1%, 5.8%, 7.8%, and 3.4%; rates of Syphilis infection were 21.8%, 36.2%, 11.8%, and 13.8%; rates of inconsistent condom use were 57%, 52%, 58%, and 38%. Significant differences were found in various sociodemographic characteristics (e.g., age, migration history, education, income, places of employment) and risk behaviors (e.g., age at first sex, number of sex partners, involvement in commercial sex, and substance use) among samples recruited by different sampling methods. The results confirmed the challenges of obtaining representative MSM samples and underscored the importance of using multiple sampling methods to reach MSM from diverse backgrounds and in different social segments and to improve the representativeness of the MSM samples when the use of probability sampling approach is not feasible.

Keywords

HIV; MSM; Migrant workers; Sampling methods; China

Introduction

Men who have sex with men (MSM) have increasingly contributed to the rapid expansion of the HIV epidemic in China. The percentages of newly reported HIV infection cases that were attributable to homosexual transmission were 0.2% in 2001 (China Ministry of Health [CMOH], & UN Theme Group on HIV/AIDS [UNTG], 2003), 7.3% in 2005 (CMOH, The

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Joint United Nations Programme on HIV/AIDS [UNAIDS], & World Health Organization [WHO], 2006), 12.2% in 2007 (CMOH & UNTG, 2007), and 32.5% in 2009 (CMOH, 2009). A 2008 national survey among MSM from 61 cities in China revealed that 4.8% of MSM were infected with HIV (CMOH, 2009). MSM have become one of the most-at-risk populations in the HIV/AIDS epidemic in China. However, research of MSM in China is faced with many challenges, one of which is the representativeness of the study samples.

Due to the hidden nature of MSM, population-based or probability-based sampling as the gold standard for acquiring representative data faces enormous challenges for at least two reasons. First, since MSM amount to a relatively small proportion of the general population, population-based survey samples need to be very large to include enough MSM for accurate estimates (Kendall et al., 2008). Second, due to the stigmatization and discrimination associated with their behaviors, MSM are often under-represented in probability samples such as random household surveys or random digit dial telephone surveys (Kendall et al., 2008). In addition, in many resource-limited settings including China, probability sampling is not always feasible due to the high cost and requirement of methodological expertise from the researchers.

Similar to situations in other countries (Schwarcz, Spindler, Scheer, Valleroy, & Lansky, 2007), convenience sampling methods have been widely used in recruiting MSM in China. Network-based sampling (e.g. informal social network sampling or snowball sampling) is one such technique and has proven to be efficient in identifying and recruiting hidden populations by having members of the target population recruit other members (Erickson, 1979). However, network-based sampling alone may produce a biased sample because the final composition of the sample is heavily dependent upon the choice of seeds (initial recruits) and short recruitment chains within their own social network (Kendall et al., 2008). Respondent-driven sampling (RDS) has been recently used in MSM studies to overcome the shortcomings of conventional network-based sampling by using diverse seeds, recruitment limits (usually three recruits for each respondent), longer recruitment chains, and statistical adjustment for the sizes of participants' social networks (Heckathorn, 1997, 2002; Ramirez-Valles et al. 2005). However, using RDS among MSM faces a number of challenges such as failing to reach equilibrium for the key variables (e.g., age, education, and gender), members of the networks unwilling to recruit from their peers, and possible prolonged length of recruitment (Malekinejad et al. 2008). In addition, methodological complexity further limits the use of RDS sampling in China, which involves complicated algorithm and requires specialized software that allows limited bivariate and multivariate analyses (He et al. 2008; Ma et al. 2007; Ruan, et al. 2009).

Venue-based sampling is another frequently used sampling method in recruiting MSM in China. Venue-based sampling usually recruits MSM samples from venues in which MSM are likely to congregate (e.g., gay bars, clubs, parks, and saunas) (Choi, Diehl, Guo, Qu, & Mandel, 2002; Kendall et al., 2008; Watters & Biernacki, 1989). It is convenient to reach and recruit a large number of hard-to-reach populations at venues where it is easier to identify and access potential participants. The disadvantage is that the samples are more likely to “overrepresent” individuals whose behaviors are more visible such as those MSM who are “coming out” in terms of their homosexual orientation while potentially missing those who are “hidden” or less accessible (Johnston, Sabin, Mai, & Pham, 2006; Kendall et al., 2008; Magnani, Sabin, Saidel, & Heckathorn, 2005; Ramirez-Valles, Heckathorn, Vazquez, Diaz, & Campbell, 2005; Semaan, Lauby, & Liebman, 2002).

With increasing access to the Internet and growing popularity among MSM in seeking sex partners online, the Internet has also been increasingly used to recruit MSM in China (He et al. 2009; Lau, Lau, Cheung, & Tsui, 2008). Besides the advantages of faster recruitment and

lower operational cost, Internet sampling also provides participants a greater level of anonymity and thus has the potential to capture more “closeted” MSM (i.e., without self-disclosure of their sexual orientation) compared to those recruited from venues (Chiasson et al. 2006; Pequegnat et al. 2007; Ross, Tikkanen, & Mansson, 2000; Zhang, Bi, Hiller, & Lv, 2008). Nevertheless, Internet sampling is subject to selection biases, as it could only sample those MSM who have access to the Internet and have used the Internet as a means of seeking sex partners. Internet samples may therefore be limited in their representativeness of the broader MSM population (Pequegnat et al. 2007).

In addition to the methodological limitations of each individual sampling method, the complex social structure of the MSM population also poses challenges in obtaining representative samples. Previous research pointed out that the MSM population is not homogeneous, but segmented (Choi et al., 2002). In their qualitative research, Choi and colleagues found that the MSM population in Beijing is multisegmented along the lines of types of venues, locations of socialization (e.g., private homes or public venues), education, social class, age, residence status (e.g., Beijing locals or migrants), and involvement in commercial sex (Choi et al., 2002). These different segments of MSM usually remained separate in their social circles. While sexual mixing across various subgroups could be found in public venues such as bars, clubs, parks, teahouses and saunas, it was suggested that members of different segments (e.g., “sauna, bathhouse, or park goers”, “private socializers”) may hardly interact across segments in their social lives (Choi et al., 2002).

Although each of these convenience sampling approaches suffers from some methodological drawbacks, it is likely that they will be continuously employed in the field due to their high feasibility and low cost. Researchers have called for comparisons of data collected by different sampling methods in order to fully understand the potential biases (or uniqueness) of each sampling approach and to improve the representativeness of the data (Schwarcz, Spindler, Scheer, Valleroy, & Lansky, 2007). Previous studies in both the U.S. and China have suggested differences in both demographic characteristics and sexual risk profile among MSM recruited from different sampling methods (Rhodes, DiClemente, Cecil, Hergenrather, & Yee, 2002; Ross, Tikkanen, & Mansson, 2000; Xing, Zhang, Chen, & Zheng, 2008; Zhang, Bi, Hiller, & Lv, 2008). However, these studies were limited in numbers and scopes and most of them only examined the differences between the Internet-based and “offline” samples (Rhodes, DiClemente, Cecil, Hergenrather, & Yee, 2002; Ross, Tikkanen, & Mansson, 2000; Xing, Zhang, Chen, & Zheng, 2008; Zhang, Bi, Hiller, & Lv, 2008). Therefore, the current study was designed to examine the differences in sociodemographic characteristics, rates of HIV and Syphilis infection, and sexual risk behaviors among young migrant MSM in China recruited with four different sampling methods.

Methods

Study Sites and Sampling Methods

The study was conducted in Beijing, China, in 2009. As the capital of China, Beijing has a total population of 17 million, including about 4 million migrants (Li, Lu, & Zhou 2006). MSM accounted for 44.11% of the newly reported HIV infected cases in Beijing in 2009 (Xinhua News Agency, 2009). Participants in the current study were recruited through four sampling methods: (1) Peer outreach. Three MSM were hired and trained by a local CDC as peer outreach workers to approach MSM based on their personal connection to and knowledge of the MSM population in Beijing; (2) Informal social network. The eligible MSM who agreed to participate were asked to refer their friends to participate in the study; (3) The Internet. The local research team distributed announcements via local gay websites to reach potential participants; and (4) Venue-based sampling. MSM-frequented venues

were identified and owners or managers of these venues were asked to distribute the study information to their members and encourage them to participate.

Participants and Consenting Process

Participants' inclusion criteria include having had sex with men in the past, being 18-30 years old, being migrants (without a permanent household registration in Beijing), and being willing to provide blood specimens for HIV/STD testing. The recruitment and consenting procedures have been described in detail elsewhere (Song et al., 2010). Briefly, when a potential participant was referred or identified through one of the sampling methods, local research team members would verify his eligibility, and then explain to the participant the research design and potential risks and benefits of participating in the study. All participants were assured of confidentiality of their participation. A total of 317 MSM were approached and 311 (98%) agreed to participate and provided written informed consent. All participants were verified individually through a brief face-to-face screening and checking of names and cell phone numbers to make sure that there were no duplicate inclusions of same individuals from different sampling approaches. Four participants with substantial missing data in their surveys were excluded from the dataset, resulting in 307 MSM in the current study. The research protocol, including consenting procedure, was approved by the Institutional Review Boards at both Wayne State University in the U.S. and Beijing Normal University in China.

Survey and HIV/STD Testing Procedure

Participants completed a self-administered survey privately in either a local CDC or a community medical center in Beijing. Interviewers were faculty members and graduate students in psychology at a local university as well as health workers from a local CDC. Prior to data collection, all interviewers received extensive training on research ethics and assessment methodology. On average, participants took about 45 minutes to complete the questionnaire. Participants received a small monetary incentive (equivalent to US \$2) for their participation and reimbursement for their transportation expenses (up to US \$5) upon completion of the survey. All participants provided blood specimens for testing of HIV and Syphilis. The local CDC made appropriate referral arrangements for all participants who were confirmed to be HIV positive to receive counseling and free treatment. Free treatment was also provided to those who were positive on Syphilis testing, following China CDC's guidelines on STD treatment.

Measures

Sociodemographic factors—Participants were asked about their sociodemographic characteristics in the survey. These characteristics include age (in years), ethnicity (Han vs. non-Han), marital status (never married, married/cohabitation, separated/divorced/widowed), educational attainment ($\leq$ middle school, high school, $>$ high school), sexual orientation (homosexual, bisexual, or others), places of employment (company/factory, entertainment establishment, or others), number of work places during last year, average monthly income (in Chinese currency RMB), types of original residence before migration (city, town, or rural area), living arrangement (alone, with family members, with co-workers, with lover, or with others), and health insurance coverage (yes/no). Participants were also asked about their migration history including total duration of migration, duration of migration in Beijing, and number of cities stayed during migration.

Sexual risk behaviors—The sexual risk behaviors included age of sexual debut, number of male and female sex partners during last week and in lifetime, gender of their stable or casual sex partners (women only, men only, or both men and women), inconsistent condom use in anal sex (yes/no), and involvement in commercial sex in the past six months (sold sex

to or bought sex from either men or women). Participants were also asked whether they or their sexual partners drank alcohol or used drugs before sex.

Peer HIV/AIDS infection and risk behaviors—Participants were queried about their perceptions of the HIV and STD infection status of their MSM friends as well as peer's involvement in risk behaviors including inconsistent condom use, commercial sex (sold sex to either men or women), and alcohol and drug use. If they did not perceive any of their MSM friends being infected with HIV or STD or engaged in a specific risk behavior, the response was coded as 0, otherwise it was coded as 1.

Statistical Analysis

Analysis of variance (ANOVA) for continuous variables or chi-square test for categorical variables was performed to examine the differences in individual characteristics, rates of HIV and Syphilis infection, and sexual risk behaviors among the four MSM samples. In addition, multivariate analysis using general linear model (GLM) was employed to assess the independent effect of sampling methods in relation to participants' various sexual risk behaviors, controlling for participants' sociodemographic variables. Various sexual risk behaviors were employed as dependent variables in the GLM analyses. The sampling method (peer outreach, social network, Internet, and venue-based) was employed as the main between-subjects factor in the GLM analysis. Because of the documented relationship between sexual risk and workplace among the MSM population in China (Liu, Liu, Cai, Rhodes, & Hong, 2009), place of employment (company/factory, entertainment establishment, or others) was also included as a between-subjects factor in GLM analysis. Sociodemographic characteristics that were significantly correlated with sampling methods in bivariate analyses were included as covariates in the GLM. All the statistical analyses were conducted using SPSS for Windows 15.

Results

Sociodemographic Characteristics

As shown in Table 1, MSM in the current study had a mean age of 23.73 years ($SD=2.86$). Most of them were never married, of Han ethnicity, with at least high school education. On average, their total duration of migration and duration in Beijing were about four and three years respectively. They had stayed in about three cities during their migration, worked in two places last year, and made about 2,200 RMB (about \$331) monthly. About one third of the MSM worked in companies or factories and about one in six worked in entertainment establishments (e.g., saunas, bars, massage venues, KTV, or salons). Only less than one third of the MSM had some form of health insurance. Most of them lived alone, followed by living with co-workers, lovers, and family members. A majority of them self-identified as homosexual (60%) and about one third as bisexual.

MSM in the peer outreach sample ($n=78$; 25%) were the youngest and had the highest educational attainment, shortest total duration of migration, least number of cities stayed during migration, and highest rate of health insurance. The social network sample ($n=69$; 23%) was the oldest and most likely to work in companies or factories, with the longest total migration duration and duration in Beijing. A most notable characteristic among the Internet sample ($n=102$; 33%) was its least amount of monthly income (1835 RMB, or \$276). The venue-based sample ($n=58$; 19%) stayed in more cities during migration and had shorter duration in Beijing than other samples. The venue-based sample had received the lowest education, but reported the highest monthly income (2609 RMB, or \$392); it had the highest proportion of MSM working in entertainment establishments (33%) and living with co-workers (36%), but the lowest rate of health insurance (12%).

HIV and Syphilis Prevalence

As shown in Table 2, the overall HIV infection rate was 5.9% (n=18) among the entire sample and Syphilis infection rate was 20.2% (n=62). Among the four samples, the Internet sample had the highest HIV infection rate (7.8%), whereas the venues-based sample had the lowest HIV infection rate (3.4%), and those recruited through peer outreach and social network were in the middle (5.1% and 5.8%, respectively). The social network sample had the highest Syphilis infection rate (36.2%), followed by the peer outreach sample (21.8%), the venue-based sample (13.8%), and the Internet sample (11.8%).

HIV Risk Behaviors and Perceptions

The data showed statistically significant differences in many sexual risk behaviors among different samples (Table 2). Among the four samples, the peer outreach sample was most likely to have men as stable sex partner. The social network sample was the oldest in sexual onset, was most likely to have both male and female stable sex partners (18%), was least likely to engage in commercial sex, and had fewest female sex partners in lifetime.

The Internet sample had fewest male sex partners in lifetime and was most likely to have men as their casual sex partners. Their MSM friends were least likely to be involved in commercial sex and to use drugs. The venue-based sample was the youngest in sexual onset, had most sexual partners (both male and female) in lifetime, and was most likely to have female stable or casual sex partners. MSM recruited from venues were most likely to use drugs and engage in commercial sex, but they were also most likely to use condoms (with the lowest rate of inconsistent condom use). These venue-based MSM were also more likely to perceive their MSM friends to use drugs and engage in commercial sex.

Multivariate Analysis

After controlling several key demographic factors, GLM analysis showed significant differences by sampling methods in various sexual risk behaviors, as shown in the multivariate test and five of the eight univariate tests (Table 3). Places of employment also showed significance in the multivariate test and two of the eight univariate tests. Among the covariates, age, number of cities stayed during migration, duration in Beijing, living with co-workers, and having health insurance showed statistical significance in the multivariate test.

There was a significant interaction term between sampling methods and places of employment in the multivariate test and three of the ten univariate tests ($p < .05$). Further examination of the estimated marginal means revealed that the significant interaction term was the result of the differences in the number of sexual partners and drug use among MSM at different places of employment by different sampling methods. For example, among the venue-based sample, those who worked in entertainment establishments had substantially more male sex partners than those who worked in companies/factories or other places. Conversely, among the social network sample, those who worked in entertainment establishments had less male sex partners than MSM at other places of employment.

Discussion

Data in the current study demonstrate significant differences in various sociodemographic characteristics, sexual risk behaviors, and rates of HIV/STD infection among a subgroup of MSM (e.g., migrant MSM) recruited by different sampling methods. In addition, the differences in sexual risk behaviors among different samples could not be fully explained by the differences in place of employment and other demographic characteristics. The findings in the current study confirmed the challenges of obtaining representative MSM samples using convenience sampling approaches and suggested that each sampling method might

reach different segments of MSM population (Choi et al., 2002) and the potential biases in the data might reflect some unique characteristics of the segments or the sampling methodology.

Venue-based sampling was more likely to recruit MSM who engaged in commercial sex (with both men and women) and substance use prior to sex. However, the venue-based sample had the lowest rate of inconsistent condom use, which might partly explain their lower HIV and Syphilis infection rates. The lower rate of inconsistent condom use and HIV/STD infection might be the result of higher level of self-awareness of their involvement in high risk behaviors (such as commercial sex, sex under the influence of drugs). Likewise, because of their known commercial sex and drug use activities, these venues were most likely to become the targets of existing HIV/STD prevention intervention efforts (such as condom promotion), which were likely to increase their condom use and decrease their HIV/STD infections among MSM in these venues.

Compared with other sampling methods, informal social network sampling in the current study recruited older MSM who were less likely to work in entertainment establishments but more likely in companies or factories. This network-based sample had the highest Syphilis infection rate (36.2%) and was most likely to have both men and women (18%) as stable sexual partner. The social network sampling may be an appropriate approach to reach MSM in non-entertainment sectors and with higher rates of bisexual behaviors. The Internet-based sample in the current study had the highest proportion of MSM self-identifying as homosexual (66%), which may support the potential of the Internet-based approach to capture more “closeted” MSM because of its greater level of anonymity (Chiasson et al. 2006; Pequegnat et al. 2007; Zhang et al., 2008). However, future study is needed to explain the seemingly counterintuitive result in the current study that the Internet sample had the least monthly income.

There was an inconsistent pattern between rates of HIV infection and rates of Syphilis infection across different MSM samples. For example, the Internet sample had the highest HIV infection rate but the lowest Syphilis infection rates, the venue-based sample had the lowest HIV infection rate and the second lowest Syphilis infection rate. Although reasons for such a pattern cannot be determined by the current data, the causes of such differences among samples may be beyond simple “sampling errors”. Future study is needed to explore the possible relationship among sampling characteristics and HIV and Syphilis infections.

The current study is subject to several limitations. First, there might be potential methodological overlap among the four sampling methods. For example, peer outreach sampling could possibly overlap with both venue-based and social network sampling (as the peer outreach workers might have used some MSM venues or their own social network for recruiting). Second, since the sample was recruited from a single metropolitan area and all the MSM were migrants, our findings may not be generalizable to other MSM populations in China.

Despite these potential limitations, the current study is one of the first efforts to address the issue of sample representativeness among MSM and other most-at-risk populations in China. The results in the current study underscore the importance of using multiple sampling methods to reach different segments of MSM who are from diverse backgrounds and with substantially different sexual risk profiles for purposes of both HIV/STD surveillance and prevention. Future studies among this hard-to-reach population need to improve the representativeness of the sampling methods and to reduce the sampling errors and improve the precision of statistical results. Findings in the current study also suggest the need for future HIV/STD intervention efforts among MSM to be sensitive to the potential differences

among different segments of MSM population in China. The persistent differences in sexual risk behaviors among different MSM samples after controlling for demographic characteristics suggest that the differences among these samples may not be merely the results of sampling variation in characteristics (age, education, income, etc), but might be the results of some systematic environmental or structural influences associated with each of the segments of MSM population. Future research is needed to identify such environmental or structural influences and future HIV prevention intervention efforts should be designed to be responsive to these influences. Future intervention effort may also employ different intervention approach targeting different groups of MSM (e.g., social network based, Internet-based, or venue-based intervention).

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Table 1
Sociodemographic characteristics among MSM recruited from different sampling methods

Characteristics	Sampling methods				Venue
	Total	Peer Outreach	Network	Internet	
Sample size	307 (100%)	78 (25%)	69 (23%)	102 (33%)	58 (19%)
Age (years)	23.73 (2.86)	22.65 (1.59)	24.70 (2.87)	23.76 (3.17)	23.98 (3.19)
Duration of migration (months)	49.27 (30.98)	39.60 (25.95)	59.30 (33.81)	48.83 (30.81)	51.10 (30.72)
No. of cities stayed	2.71 (2.95)	2.01 (1.58)	3.07 (4.36)	2.34 (2.06)	3.84 (3.26)
Duration in Beijing (months)	36.16 (27.19)	32.26 (23.80)	48.19 (31.77)	33.73 (25.58)	31.37 (24.70)
No. of work places (last year)	1.92 (2.54)	1.62 (1.61)	1.86 (1.87)	1.88 (3.52)	2.48 (2.11)
Monthly income (100 yuan)	22.08 (16.80)	23.60 (15.86)	22.51 (18.00)	18.35 (15.18)	26.09 (18.33)
Han ethnicity	282 (92%)	69 (89%)	63 (91%)	98 (96%)	52 (90%)
Education					***
≤ Middle school	51 (17%)	7 (9%)	13 (19%)	15 (15%)	16 (28%)
High School	121 (39%)	23 (30%)	24 (35%)	45 (44%)	29 (50%)
> High school	135 (44%)	48 (62%)	32 (46%)	42 (41%)	13 (22%)
Marital status					
Never married	279 (91%)	77 (99%)	60 (87%)	90 (88%)	52 (90%)
Married/cohabitation	17 (5%)	1 (1%)	5 (7%)	8 (8%)	3 (5%)
Separate/divorced/widowed	11 (4%)	0 (0%)	4 (4%)	4 (4%)	3 (5%)
Employment					***
Company/factory	93 (30%)	28 (36%)	32 (46%)	25 (25%)	8 (14%)
Entertainment	48 (16%)	12 (15%)	6 (9%)	11 (11%)	19 (33%)
Other	166 (54%)	38 (49%)	31 (45%)	66 (65%)	31 (53%)
Sexual orientation					
Homosexual	184 (60%)	48 (62%)	42 (61%)	67 (66%)	27 (47%)
Bisexual	95 (31%)	27 (35%)	21 (36%)	26 (26%)	21 (36%)
Other	28 (9%)	3 (4%)	6 (9%)	9 (9%)	10 (17%)
Original residence					
city	102 (33%)	34 (44%)	20 (29%)	30 (29%)	18 (31%)
Town	107 (35%)	22 (28%)	27 (39%)	40 (40%)	18 (31%)

Characteristics	Sampling methods			
	Total	Peer Outreach	Network	Internet
Rural	98 (32%)	22 (28%)	22 (32%)	32 (31%)
Living arrangement				22 (38%)
Alone	128 (42%)	36 (46%)	28 (41%)	41 (40%)
With family members	41 (13%)	14 (18%)	6 (9%)	12 (12%)
With co-workers	67 (22%)	11 (14%)	11 (16%)	24 (24%)
With lover	59 (19%)	11 (14%)	20 (29%)	21 (21%)
Other	24 (8%)	8 (10%)	6 (9%)	8 (8%)
Health insurance				2 (3%)
Yes	89 (29%)	27 (35%)	22 (32%)	33 (32%)
				7 (12%) *

Note: For continuous variables including age, total time, number of cities stayed, duration in Beijing, number of working places and income, mean and SD are reported. For categorical variables, number of cases and percentage are reported.

* p<0.05;
 ** p<0.01;
 *** p<0.001

Table 2
HIV and Syphilis prevalence and HIV risk behaviors and perceptions by different sampling methods

Characteristics	Sampling methods				Venue
	Total	Peer Outreach	Network	Internet	
HIV					
Yes	18 (5.9%)	4 (5.1%)	4 (5.8%)	8 (7.8%)	2 (3.4%)
Syphilis					
Yes	62 (20.2%)	17 (21.8%)	25 (36.2%)	12 (11.8%)	8 (13.8%) ***
Sexual Risk Behaviors					
Age at first sex					
Mean (SD)	19.25 (2.52)	18.86 (2.08)	19.94 (2.39)	19.46 (2.47)	18.60 (3.05) **
No. of sex partners in the last week					
Male partners	1.38 (1.62)	1.13 (1.12)	1.67 (2.64)	1.29 (1.21)	1.52 (1.11)
Female partners	0.12 (0.47)	0.13 (0.63)	0.04 (0.21)	0.03 (0.17)	0.36 (0.69) ***
No. of sex partners in lifetime					
Male	49.52 (109.83)	33.60 (64.38)	56.10 (103.90)	27.64 (57.08)	101.59 (191.02) ***
Female	2.15 (7.05)	2.27 (4.48)	0.74 (1.27)	1.03 (2.52)	5.62 (14.49) ***
Stable sex partners					*
Women only	18 (9%)	3 (5%)	1 (2%)	6 (10%)	8 (25%)
Men only	153 (77%)	48 (86%)	41 (80%)	45 (74%)	19 (59%)
Both men and women	29 (15%)	5 (9%)	9 (18%)	10 (16%)	5 (16%)
Casual sex partners					*
Women only	2 (1%)	1 (1%)	0 (0%)	0 (0%)	1 (2%)
Men only	236 (77%)	58 (75%)	56 (82%)	86 (85%)	36 (62%)
Both men and women	66 (22%)	18 (23%)	12 (18%)	15 (15%)	21 (36%)
Inconsistent condom use in anal sex	161 (53%)	44 (57%)	36 (52%)	59 (58%)	22 (38%)
Involved in commercial sex in the past six months	69 (23%)	14 (18%)	11 (16%)	18 (18%)	26 (45%) ***
Substance use (before sex)					
Alcohol	120 (39%)	31 (40%)	24 (35%)	37 (36%)	28 (48%)
Drug use	9 (3%)	2 (3%)	1 (1%)	1 (1%)	5 (9%) *
Perceived peer HIV/AIDS infection and risk behaviors					

Characteristics	Sampling methods				
	Total	Peer Outreach	Network	Internet	Venue
HIV infection	59 (20%)	13 (17%)	20 (29%)	16 (16%)	10 (17%)
STD infection	123 (40%)	32 (41%)	27 (39%)	37 (36%)	27 (47%)
Inconsistent condom use	43 (14%)	5 (6%)	14 (20%)	10 (10%)	14 (24%)
Ever involved in commercial sex	148 (48%)	31 (40%)	38 (55%)	40 (39%)	39 (67%) **
Alcohol use	283 (92%)	73 (94%)	65 (94%)	92 (90%)	53 (91%)
Drug use	59 (19%)	17 (22%)	12 (17%)	12 (12%)	18 (31%) *

* p<0.05;

** p<0.01;

*** p<0.001

Table 3
Results of General Linear Model: Relationship between risk behaviors and sampling methods

	Main Effect			Interaction		Covariate				
	Sampling methods	Employment	Sampling methods X Employment	Age	No. of cities stayed	Duration in Beijing	Income	Education	Living with co-workers	Health insurance
Multivariate Test	2.78 ***	2.98 ***	1.55 **	6.47 ***	3.54 ***	2.64 **	< 1	1.62	2.25 *	2.13 *
Age at first sex	3.76 *	3.18 *	1.30	43.09 ***	3.47	1.40	3.81	0.04	0.03	8.40 **
No. of male sex partners last week	1.20	2.91	0.67	1.34	0.05	1.78	0.15	5.67 *	0.25	0.54
No. of female sex partners last week	3.12 *	0.07	0.84	0.01	0.78	0.36	0.09	7.16 **	6.04 *	0.88
No. of male sex partners in life	3.94 **	4.24 *	3.54 **	0.02	10.30 ***	10.83 ***	0.18	0.14	1.03	0.75
No. of female sex partners in life	11.26 ***	8.53 ***	2.80 *	3.30	10.48 ***	6.54 *	0.46	1.09	0.53	1.97
Inconsistent condom use	1.96	1.49	0.91	0.03	4.34 *	1.09	0.32	0.27	0.46	0.17
Involvement in commercial sex	2.45	1.38	0.93	1.02	1.75	0.02	1.08	0.02	7.97 **	0.82
Drug use	5.38 ***	2.40	2.44 *	5.18 *	4.73 *	6.99 **	0.41	0.04	1.22	3.32

* p<0.05;

** p<0.01;

*** p<0.001