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Running title: Sexual practices and prevalence of HIV & syphilis
SUMMARY

To assess the risk of sexual practices and explore the determinants of the prevalence of HIV and syphilis among men who have sex with men (MSM) in Lanzhou, China, a survey was conducted among 600 MSM from March 2008 to December 2009, demographic information and sexually behavioral factors were collected with snowball sampling technology and blood samples were obtained. Multivariate logistic regression models were used to determine the predictors of HIV and syphilis infection. The sera-prevalence of HIV, syphilis, HCV and co-infection of HIV with syphilis was 6.0%, 18.0%, 1.3% and 2.5% respectively. Inconsistent utilization of condom in vaginal sex was higher than that in anal sex, buying sex or selling sex. Multivariate analysis shows that syphilis infection, MSM from other provinces and Han ethnicity are more likely to have a HIV infection; HIV infection, inconsistent condom use and less knowledge about AIDS prevention were more likely to have a syphilis infection. Inconsistent utilization of condom in vaginal sex was higher than that in anal sex among MSM, whose social background, condom use and infection may affect the prevalence of HIV or syphilis. These findings may have some implications for further behavioral intervention among this population.
INTRODUCTION

By the end of 2009, there had been approximately 740,000 people with HIV/AIDS in China, among whom 14.7% were infected through male homosexual transmission.(1) Compared with those in 2007 and 2005, the proportion was raised by 3.7% and 7.4% respectively. Furthermore, it is estimated that 48,000 cases have been newly infected with HIV, of whom more than 30% was infected via male homosexual transmission.1These data imply that China is facing a rapid growth of HIV epidemic among men who have sex with men (MSM).(2)

Among the high-risk groups of HIV infection, MSM play an important role in transmitting HIV and other sexually transmitted infections (STIs) from their high-risk male sexual partners to their low-risk female partners.(2) However, unprotected sexual behaviors facilitate the transmission. The high-risk behaviors among MSM, which have been documented in different counties all over the world, including China,(3) make MSM highly vulnerable to HIV infection and other STIs. Diverse interventions such as community-based peer intervention, intervention to increase condom use and HIV testing, healthcare provider intervention, internet-based intervention, integrated HIV prevention interventions, peer-led interventions, also had been conducted to control the transmission of STIs in China.(4-8)

Some studies have found that there exists disproportionate co-infection with other pathogens including syphilis and HCV in the people infected with HIV.(9-12) Genital ulcerative diseases have much greater risk of co-infection with HIV.(9,13) Though co-infections of HIV have very complex mechanism, they as such may reveal the
common risk and provide some new information for the development of effective prevention and intervention strategies.

In this study, we tried to assess different types of sexual behaviors and the prevalence of HIV, syphilis and HCV, and thereby explore the determinants of HIV and syphilis among MSM so as to provide insights into the prevention of HIV or STIs among MSM.

MATERIALS AND METHODS

Setting and sampling

The survey was conducted from March 2008 to June 2009 in Lanzhou, where the prevention and control of AIDS among MSM had just started, and this group was hard to reach with traditional household-oriented or venue-based methods. So the snowball technique was employed to recruit all participants from MSM population in Lanzhou. Six volunteers recruited by MSM community personnel acted as the ‘seeds’. Some appointment cards containing some details of survey were distributed to their friends among the subpopulation. The HIV voluntary counseling and testing clinic affiliated by Lanzhou Center for Disease Control and Prevention was designated as a main appointment place. For some MSM under appointment who were reluctant to go to the clinic, some flexible strategies such as the interviewer-door, in-the-bar-of-MSM interview, were adopted.

All the participants were initially surveyed and screened against the eligibility criteria
which included: (i) aged 18 years or older and (ii) any history of sex with other men.

At the beginning of the survey, the interviewer briefly introduced himself and the study. Then, he went through a series of formalities with the participant including the importance and nature of confidentiality, issues related to the collection of information, the right not to participate and to withdraw from participation, incentive distribution, referral information related to sexual health issues and access to the final report. All those who were eligible and willing to participate in the study after providing written informed consent had a questionnaire of 30 minutes or so administered by a trained interviewer, which involved the demographic information (age, education, employment, marital status, residence, income and self-identity), their engagement in risky behaviors (first insertive sex, commercial bisexual behavior, heterosexual behavior, number of sex partners, condom use, the history of the symptoms of STI) and their history of HIV testing, their experience of accepted intervention and their knowledge about AIDS. Each of them was paid 40 RMB Yuan (about US $6.0) for their time after the interview. The study was reviewed and approved by the Ethics Committee at Lanzhou center for Disease Control and Prevention.

**Sample collections**

Data were collected through an interviewer-administered questionnaire on the basis of a one-to-one interview. Each participant was assigned a unique and confidential identification code for the questionnaire and specimens. The collected demographic
information included age, ethnicity, education, employment, current marital status, income, residence and places of seeking sex partners frequently. Questions pertaining to behavior and practices included self-identified sexual orientation, age of initiating sex, especially with men, and lifetime number of male partners. Questions also addressed paying or selling sex and heterosexual behaviors over the past 6 months as well as condom use in sexual behaviors. The samples of whole blood (5ml) were collected in blood collection tubes of negative pressure by laboratory personnel accompanied with the interviewers after each interview was over. All the samples were transferred to the laboratory for testing no more than 6 hours after collection to be tested for HIV, syphilis and Hepatitis C virus (HCV).

**Sera testing**

All assays were carried out according to the manufacturer’s instructions. HIV was first tested by ELISA (enzyme-linked immunoassay) kits (Hangzhou ACON, Hangzhou, China) in Lanzhou Center for Disease Control and Prevention and positive samples were sent to AIDS Central Laboratory of Gansu Center for Disease Control and Prevention to be confirmed by WB (Western Blot: Beijing Wantai, Beijing, China). RPR (rapid plasma regain; Beijing Jinhao, Beijing, China) kits were used to screen for syphilis, and positive samples were confirmed by TPPA (Treponemal Pallidum Particle Agglutination; Shanghai Xinran, Shanghai, China) test. A positive RPR (at any titer) and TPPA test was identified as a syphilis infection. HCV was tested by ELISA (Shanghai Branch, Shanghai, China). All serum samples were assayed in
duplicate.

**Measurements**

The outcome variables of interest included the occurrences of HIV and syphilis infection. An indicator of knowledge about HIV prevention proposed by UNGASS (United Nations General Assembly Special Session on HIV/AIDS) was adopted in the study. (15) If a respondent can give the correct answers to all of the 5 questions (HIV can be avoided by having sex with only one faithful uninfected partner, HIV can be avoided by using condoms, a healthy-looking person can have HIV, a person can get HIV from mosquito bites and a person can get HIV by sharing a meal with someone who is infected), he will be considered knowing about AIDS prevention. If a participant had not or occasionally used condom in each vaginal or anal sex in recent six months, he was considered as an inconsistent user. Among six items of the accepted intervention services within last six months (condom, lubricants, peer education, STD screening and treatment, HIV counseling or testing and AIDS and STD promotional materials), more than 2 items were considered as effective intervention.

**Statistical analysis**

EpiData 3.1 software (EpiData Association Odense, Denmark) was used for dual data entry and statistical analyses were performed using SPSS17.0 (SPSS Inc, Chicago, IL, USA). Chi-square test was used to compare the proportion of categorical variables. The multivariate logistic regression models were employed to identify the predictors
of the outcome variables. All possible influencing factors were entered together into their corresponding model. The level of significance of analysis was set at 0.05.

RESULTS

Background characteristics of participants

Table 1 showed socio-demographic characteristics and behavior-related factors among MSM. The participants in the study included 317 self-identified homosexual men, 258 self-identified bisexual men and a few of self-identified heterosexual or unsure men. Of the participants, more than one-third was businessmen. Almost all were below 45 years in age. The average age was 30 years. The overwhelming majority (93%) had an above-primary-school degree. Nearly two thirds (64.17%) were unmarried men. More than a half came from the city. 85% were of Han ethnicity. Recreation, bathing facilities and internet were the main means of their seeking partners. Most of them (90.34%) earned less than 3000 RMB Yuan per month. Of 6 accepted intervention services, the proportion of condom distribution among them attained to 72.16% but that of STD screening and treatment was only 24.5%. Slightly more than two-thirds of them accepted more than 2 items of these services. In the last 12 months, over one third of them participated in HIV-test at least one time and most of them knew their testing results. The proportion of the participants knowing about AIDS prevention was slightly more than one half (52%). Only 1.33% has ever used addictive drugs.

Sexual practices

Table 2 depicted anal homosexual behavior, commercial homosexual behavior and heterosexual behavior among MSM. Of the participants, there were more of them who had the first sex with women rather than with men. Slight more than ten percent of the men having the first sex with men were aged below 18 years. The average age was
22.85 years. Most (84.83%) had had anal sex with men at least one time in the past six months (88.54% in self-identified homosexuals and 82.17% in self-identified bisexuals), but only one fifth had this type of sex with more than 6 men. The largest number of male partners attained to 200 people in last six months. Nearly one fourth did not use condom in the last anal sex with man and a little less than a half (45%) did not use condom consistently in this type of sex. Less than 5% paid for sex with men. Most (81%) paid for sex with two men at most. Of the men having paid sex, 22.73% did not use condom in the last sex and 31.82% used condom inconsistently in the past 6 months. However, 12.4% sold sex to some males. Different from those paying sex, more of them (63.49%) had sex with 3 or more men and some had sex with as many as 500 men in the past six months. Fortunately only 9.52% did not use condom in their last selling sex and slightly more than a quarter did not use condom consistently in the past 6 months. One third and or so (35.83%) had vaginal sex with women (18.30% in self-identified homosexuals and 57.75% in self-identified bisexuals). More than three quarters had sex with two women at most. About a half (50.24%) did not use condom in their last sex and more than six out of ten (62.33%) did not use condom consistently in recent six months.

In terms of inconsistent condom use in different types of sex behaviors, vaginal sex was more likely to be unprotected than anal sex with men ($x^2=18.74, p<0.001$), paying sex ($x^2=7.97, p<0.01$) and selling sex ($x^2=25.21, p<0.001$). The men in selling sex ($x^2=7.57, p<0.01$) seemed to use condom inconsistently less than those in anal sex with male partners, who were different from the men in paying sex ($x^2=1.53, p>0.05$) in condom use.

**HIV, syphilis, HCV and their co-infection**
Table 3 depicts the prevalence of HIV, syphilis, their co-infection and HCV among MSM. By the test of WB (Western Blot), thirty six cases were confirmed with HIV infection and its sera-prevalence rate was 6.0%. By the dual test of RPR and TPPA, 108 were determined as syphilis and its sera-prevalence rate was 18.0%. By the screening test of ELISA, 8 were considered as HCV infection and its sera-prevalence rate was 1.33%. Of all participants, 15 cases were co-infected with HIV and syphilis and the sera-prevalence of their co-infection was 2.5%, which accounted for 41.67% of the HIV-positive and 13.89% of the syphilis-positive. No case was co-infected with HCV and syphilis or HIV.

Predictors of HIV and syphilis

Table 4 shows the predictors of HIV and syphilis among MSM. Adjusted by potential confounders, MSM with syphilis infection (OR=4.03, 95%CI: 1.73-9.38) or of the Han ethnicity (OR=8.30, 95%CI: 1.06-65.05) or from other provinces (OR=2.60, 95%CI: 1.11-6.09) were more likely to have an HIV infection. MSM with HIV infection (OR=3.89, 95%CI: 1.74-8.71), using condom inconsistently (OR=2.00, 95%CI: 1.09-3.66) or less knowing about AIDS prevention (OR=0.56, 95%CI: 0.33-0.95) were more likely to have a syphilis infection.

DISCUSSION

In our study, about 35.83% of all participants had had vaginal sex with female partners, of whom 62.33% were unprotected consistently. Certainly, consistent behavioral studies had also found a high proportion of MSM who had female partners,
of whom many are married.(16) Furthermore, our study found that the proportion of inconsistent condom use in MSM’s vaginal sex with female partners was much higher than that in their anal sex, buying sex or selling sex with male partners. A possible reason was that almost all intervention services among MSM emphasized that unprotected anal sex can lead to the highest risk of transmission of HIV or other sexually transmitted infections, which may weaken the understanding of the concept of possible HIV transmission via unprotected vaginal sex to their female partners. In addition, condom use in sex with young husbands and wives are low in China because condom use in this kind of sex may be considered as mutual distrust and also seem to reduce sensation. Less condom use may increase the risk of HIV transmission from MSM to the female population. Therefore, preventive strategies should emphasize the comprehensive understanding of safe sex and protective capability of condoms in all kinds of sexual behaviors among the population.(17)

In the current study, the data about sex with female partners also showed that 18.33% of self-identified homosexual men had sex with women in recent six months and 57.75% of self-identified bisexual men had not. So, self-identified sexual orientation did not accurately define behavior.(18) In fact, not only in China but also in other countries all over the world, MSM behaviors are highly unacceptable. Strong social pressure and the exclusion of MSM behaviors by the family forced MSM to conceal their sexual orientation and engage unwillingly in some heterosexual relationship.(3,13,19) Even some used the marriage to disguise their MSM behaviors.(3) However, the additional effect of the HIV-transmitted bridge to the
females among MSM is involved. Relevant advocacy efforts for social acceptance and family understanding of homosexuality are needed to make more people and families accept the social phenomenon of homosexuality so as to reduce the disguising marriages or unwilling heterosexual behaviors, which may avoid some additional heterosexual transmissions of HIV.

In the study, a moderate sera-prevalence of HIV (6.3%), a high sera-prevalence of syphilis (18.0%) and a low sera-prevalence of HCV (1.3%) among MSM were described. Compared with those in other cities of China, the prevalence of HIV were higher than 1.5% and that of syphilis lower than 0.8% in Beijing(10) and the two prevalence rates were all lower than 10.8% and 26.7% in Nanjing(2). The prevalence of HCV was slightly higher than 0.9% in Beijing and 1.0% in Nanjing.(2,10) The sera-prevalence of the co-infection with HIV and syphilis attained to 2.5%, higher than 1.1% in Beijing. (11) Lanzhou was always considered as a city of low prevalence of HIV and other STIs in western China. These data may demonstrate that epidemics of HIV and other STIs among this population in cities with the presumed low-prevalence of HIV or STIs should also draw more attention. Comprehensive programs of prevention and control for HIV and other STIs among this population should be urgently carried out.

Many studies had revealed a positive relation between HIV and syphilis. (10,13,20-24) The current study supported their observation. Since syphilis and HIV had mutual promoting effect of risk and were both transmitted sexually, it is no surprise that a substantial number of people were infected with both agents. (9,25,26) In the current
study, 41.67% of the HIV-positive had been infected with syphilis. Multivariate analysis showed that inconsistent condom use can significantly increase syphilis infection. Compared with the minority ethnicities, the Han ethnicity had a higher risk of HIV probably because of the lack of constraints of religious belief in risk behaviors. Further intervention measures are urgently needed for those MSM who come from other provinces and are of the Han ethnicity. Measures should be taken to make effective surveillance of HIV and STIs and reasonable management of their unsafe behaviors. However, it is also important to raise the knowledge of AIDS prevention because the knowledge was found to be associated with the reduction of syphilis infection risk. Certainly, the association between the knowledge of AIDS prevention or inconsistent condom use and HIV infection was not found in the study. A possible reason may be that much lower infection rate of HIV than syphilis reduced the power of statistic test in a same sample size.

Some limitations in the study need to be acknowledged. Selection bias was inherent for the snowball sampling technology and the study included active and visible MSM in the hot spots thus may not be representative of the entire MSM population. (27) All the information about demographic characteristics and behavioral factors were obtained by means of self-report. Responses may be subjected to reporting bias because of social desirability.(28-30) Such bias may underestimate the prevalence of unprotected sex. Though the study covered commercial sex, a few of participants responded to these questions. These data may not have enough power to clarify some important issues of commercial sex among MSM. In addition, the information on
receptive anal intercourse, commercial bisexual behavior and heterosexual non-reproductive sex was not collected in the study, which may affect the deep analysis.

In conclusion, the inconsistent use rate of condom in the vaginal sex with female partners was much higher than that in the anal sex with male partners among MSM, whose culture and life background and condom use, together with infection itself, may affect the prevalence of HIV or syphilis. These findings may have some implications for further behavioral intervention among this population.

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DISCLOSURE STATEMENT: All authors declare no conflict of interest.
REFERENCE


risk taking among men who have sex with men in Fortaleza, Brazil. AIDS 1999;13:709-16


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<tr>
<th>Characteristics</th>
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**Income per a month (RMB)**

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<td>STD screening and treatment</td>
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<td>HIV counseling or testing</td>
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**HIV-test in recent 12 months**

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**Knowing testing results**

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**Knowing about AIDS prevention**

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**Addictive drugs**

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MSM=men who have sex with men; SD=standard deviation; STD=sexually transmitted diseases; HIV=human immunodeficiency virus; AIDS=acquired immune deficiency syndrome
<table>
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<th>Sexual behaviors</th>
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<tr>
<td>Mean(SD)[Range]</td>
<td>22.85(6.07)[15-50]</td>
<td></td>
</tr>
<tr>
<td>Anal sex with men within the last six months</td>
<td>509</td>
<td>84.83</td>
</tr>
<tr>
<td>Number of male partners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>163</td>
<td>32.02</td>
</tr>
<tr>
<td>2</td>
<td>130</td>
<td>25.54</td>
</tr>
<tr>
<td>3-5</td>
<td>117</td>
<td>22.99</td>
</tr>
<tr>
<td>&gt;5</td>
<td>99</td>
<td>19.45</td>
</tr>
<tr>
<td>Mean (SD)[Range]</td>
<td>5.40(14.17)[1-200]</td>
<td></td>
</tr>
<tr>
<td>Condom non-use in a last sex with men</td>
<td>113</td>
<td>22.20</td>
</tr>
<tr>
<td>Inconsistent condom use</td>
<td>228</td>
<td>44.80</td>
</tr>
<tr>
<td>Self-identified sexual orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homosexual men</td>
<td>278</td>
<td>88.54</td>
</tr>
<tr>
<td>Bisexual men</td>
<td>212</td>
<td>82.17</td>
</tr>
<tr>
<td>Others</td>
<td>17</td>
<td>77.27</td>
</tr>
<tr>
<td><strong>Commercial homosexual behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paying sex within the last six months</td>
<td>22</td>
<td>4.32</td>
</tr>
<tr>
<td>Number of paying sex partners</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>40.91</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>40.91</td>
</tr>
<tr>
<td>≥3</td>
<td>4</td>
<td>18.18</td>
</tr>
<tr>
<td>Mean (SD)[Range]</td>
<td>2.19(1.97)[1-10]</td>
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</tr>
<tr>
<td>Condom non-use in a last paying sex</td>
<td>5</td>
<td>22.73</td>
</tr>
<tr>
<td>Inconsistent condom use during paying sex</td>
<td>7</td>
<td>31.82</td>
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<tr>
<td>Selling sex within the last six months</td>
<td>63</td>
<td>12.38</td>
</tr>
<tr>
<td><strong>Number of the partners of paid sex</strong></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>15.87</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>20.63</td>
</tr>
<tr>
<td>≥3</td>
<td>40</td>
<td>63.49</td>
</tr>
<tr>
<td>Mean(SD)[Range]</td>
<td>20.92(67.21)[1-500]</td>
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</tr>
<tr>
<td>Condom non-use in a last selling sex</td>
<td>6</td>
<td>9.52</td>
</tr>
<tr>
<td>Inconsistent condom use during selling sex</td>
<td>15</td>
<td>23.81</td>
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<tr>
<td><strong>Heterosexual behavior</strong></td>
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<td></td>
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<tr>
<td>Vaginal sex in last six months</td>
<td>215</td>
<td>35.83</td>
</tr>
<tr>
<td>Number of female partners</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>---</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>1</td>
<td>166</td>
<td>74.88</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>10.23</td>
</tr>
<tr>
<td>≥3</td>
<td>27</td>
<td>12.56</td>
</tr>
</tbody>
</table>

Mean(SD)[Range] 1.90(2.88)[1-24]

Condom non-use in a last vaginal sex 108 50.24
Inconsistent condom use during vaginal sex 134 62.33

Self-identified sexual orientation
- Homosexual men 58 18.30
- Bisexual men 149 57.75
- Others 7 30.43

MSM= men who have sex with men; SD=standard deviation
TABLE 3 Prevalence of HIV, syphilis, their co-infection and HCV among MSM

<table>
<thead>
<tr>
<th>Prevalence</th>
<th>%</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>6.00</td>
<td>4.10-10.10</td>
</tr>
<tr>
<td>Syphilis</td>
<td>18.0</td>
<td>14.93-32.93</td>
</tr>
<tr>
<td>Co-infection of HIV with syphilis</td>
<td>2.50</td>
<td>1.25-3.75</td>
</tr>
<tr>
<td>HCV</td>
<td>1.33</td>
<td>0.42-1.75</td>
</tr>
</tbody>
</table>

HIV=human immunodeficiency virus; HCV=Hepatitis C virus; CI=credible interval
<table>
<thead>
<tr>
<th>Predictors</th>
<th>Univariate</th>
<th>Multivariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>uOR</td>
<td>95% CI</td>
</tr>
<tr>
<td>HIV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syphilis infection</td>
<td>3.62</td>
<td>1.80-7.27</td>
</tr>
<tr>
<td>Han ethnicity</td>
<td>6.56</td>
<td>0.89-48.49</td>
</tr>
<tr>
<td>From other provinces</td>
<td>1.65</td>
<td>0.80-3.40</td>
</tr>
<tr>
<td>Syphilis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inconsistent condom use</td>
<td>1.76</td>
<td>1.12-2.78</td>
</tr>
<tr>
<td>Knowing about AIDS prevention</td>
<td>0.69</td>
<td>0.45-1.05</td>
</tr>
<tr>
<td>HIV infection</td>
<td>3.62</td>
<td>1.80-7.27</td>
</tr>
</tbody>
</table>

1) HIV=human immunodeficiency virus;  
2) AIDS=acquired immune deficiency syndrome  
3) uOR=unadjusted odds ratio; aOR=adjusted odd ratio; CI= credible interval  
4) Only predictors at 5% of multivariate analysis model were listed.