Club Drugs and HIV/STD Infection: An Exploratory Analysis among Men Who Have Sex with Men in Changsha, China

Xi Chen1,*, Xingli Li2,*, Jun Zheng1, Junshi Zhao1, Jianmei He1, Guoqiang Zhang1, Xuemin Tang2

1 Department of AIDS/STI Control and Prevention, Hunan Provincial Center for Disease Prevention and Control, Changsha, China, 2 School of Public Health, Central South University, Changsha, China

☯ These authors contributed equally to this work.
* lixingli@csu.edu.cn

Abstract

Objective
To evaluate current club drug use and its potential association with the transmission of HIV/STD among Changsha men who have sex with men (MSM).

Method
A cross-sectional survey was conducted by using self-administered questionnaires including information regarding socio-demographics, club drug use, high-risk behaviors, and HIV/STD infections. Multiple methods including venue-based, peer referral using “snowball” techniques, and internet advertisements were used to recruit study participants.

Results
Of the 826 participants, 177 (21.4%) reported that they had used club drugs at some time before or during sex in the past six months. MSM with young age, low education level, and seeking partners through the internet or bars were the main population who used drugs. Poppers were the most common drug used among Changsha MSM. The prevalence of HIV, syphilis, and herpes simplex virus-2 were higher among drug users. There were no significant differences in unprotected sexual intercourse and condom use between drug users and non-users. Compared with non-users, risk behaviors such as group sex, multiple sex partners, and sex with foreigners were more frequent among drug users.

Conclusion
Club drug use is common among Changsha MSM, and is related to unsafe sex activities and HIV/STD infection. It is necessary to build novel targeted HIV prevention strategies to monitor and reduce club drug use among MSM.
Introduction
The HIV/AIDS prevalence among men who have sex with men (MSM) in China has increased rapidly in recent years. According to a CDC report, MSM accounted for approximately 12.2% of the newly reported HIV/AIDS cases in 2007 [1] and nearly 32.5% in 2009 [2].

Early studies suggested that a high proportion of multiple sexual partners [3] and low rates of condom use [4–6] were the main reasons for the rapid increasing HIV prevalence among MSM. Recently, some reports found that a high prevalence of club drug use and related high-risk behaviors were additional possible reasons [7–10]. Some studies in western countries demonstrated that club drug use before and during sex might increase the likelihood of high-risk sexual behaviors [11–13] and facilitate HIV/STD infection [14]. Similar to western countries, China has also seen a dramatic increase in the use of club drugs such as poppers, methamphetamine, ketamine, and ecstasy [15]. These drugs are rapidly replacing heroin and becoming the most widespread illicit drugs in China [16]. These synthetic drugs are used widely in clubs, dance halls, and places where rave parties occur. In 2010, approximately 120,000 (55%) of newly identified drug users used synthetic drugs [16].

Recently, several Chinese studies reported the extent of club drug use among Chinese male commercial sex workers (MCSW), and MSM in some regions. However, the prevalence and pattern of club drugs use varies in different regions and populations [17–18], and studies assessing the relationship between club drug use, sexual risk behaviors and HIV/STD infections are scarce.

In the current study, a cross-sectional investigation in Changsha was conducted to explore the prevalence of club drug use and assess how it relates to the spread of HIV/STI among Chinese MSM. These preliminary findings provide evidence for better implementing targeted interventions measures and strategies for MSM.

Materials and Methods

Definition of club drug and poly-drug use
Club drugs were defined as a group of substances with a connection to a club, dance scene, and rave culture [19] such as ketamine, ecstasy/MDMA, GHB, cocaine, and methamphetamine. Poly-drug use was defined as actively combining two or more substances at the same time (i.e., simultaneously or concomitantly) [20,21].

Study Site
Hunan is a landlocked province located in south-eastern China. The current study was conducted in Changsha (the Capital of Hunan province), which is famous for rich media and entertainment industries. There are hundreds of clubs, dance halls, and karaoke halls in the city.

Participants
MSM living in Changsha were recruited from August to November 2009 by using multiple methods, including at venue-based locations such as gay bars, gay saunas, parks, peer referral using “snowball” techniques, and internet advertisements. All methods were performed by trained staff at Hunan provincial CDC.

The enrollment criteria for the study were as follows: (1) males aged at least 16 years old (2) Self-report sexual behaviors with a male partner at least once in their lifetime (3) understood the purpose of the study and were willing to participate and sign informed consent.
Data collection
Self-administered questionnaires were provided and were completed by the study subjects. The questionnaires included several lines of questions as follows. (1) Demographic data including age, race, education, marital status, income, and self-reported sexual orientation. (2) Sexual behaviors, including age at first sexual intercourse with a man, the number of sexual partners, unprotected anal and oral sex in the past six months, and condom use with casual and stable partners. (3) Information regarding drug use including asking whether participants had taken drugs in the past six months. They were also asked two questions: had they ever combined one drug with another (yes/no), and, if yes, which drugs they had combined. (4) Any STD-related symptoms in the past six months.

Blood samples were collected from all eligible participants and used to assess the presence of HIV, syphilis, and herpes simplex virus 2 (HSV-2). Blood specimens were tested for HIV antibodies using enzyme-linked immunosorbent assay (ELISA) and HIV-1/2 western blotting. Syphilis antibodies were detected using a rapid regain test (RPR, Diagnosis t; Shanghai Kehua, China) and were confirmed using a Treponema pallidum particle test (TPPA, Serodia, Japan); participants were determined to be positive for syphilis if both the RPR and TPPA tests were positive. HSV-2 infection was determined by HSV-2 enzyme-linked immunosorbent assay (Herpes Simplex Virus 2 IgG, Institut Virion\Serion GmbH, Germany), as per the manufacturer’s instructions.

The study protocol was approved by the Institutional Review Board (IRB) of the First Affiliated Hospital of China Medical University (CMU).

Statistical analysis
Data were double entered and verified using Epi-Data version 3.0. Data analyses were performed using SPSS for Windows, version 13.0. Continuous variables and categorical variables were presented as means and proportions, respectively. Risk factors were assessed using chi-square statistics for categorical variables. Multiple logistic regression model was used to analyze the risk factors associated with HIV/STD infection and club drug use respectively. A backward procedure was used to select significant variables. Statistical significance was set at 0.05.

Results
Characteristics of the study participants
Of the 826 eligible participants, 584 (75.0%) were recruited from gay-oriented venues such as bars, night club and tea bars, 168 (20.3%) from the internet, and 74 (4.7%) from saunas, bath, and park. 177 (21.4%) reported that they had used club drugs at some time before or during sex in the past six months. Of these, 164 drug users were younger than 35 years old (92.6%), 82.5% were single, 27.1% had education of middle school or less, and 62.1% identified themselves as homosexual. Among the 649 non-users, 57.9% identified themselves as bisexual, 80% were aged <35 years, and >90% had a high school or higher level of education. (Table 1).

Drug use and risk factors analysis
Popper, compound codeine phosphate oral solution, and ketamine were the commonly used club drugs, especially single popper use, among Changsha MSM. Of the 177 drug users, 153 were single drug users, and 24 were poly-drug users. Of the 153 single drug users, 86.9% (133/153) used popper (volatile nitrite), 5.2% used compound codeine phosphate oral solution (8/153), 3.3% (5/153) used ketamine, 2.6% (4/153) used methamphetamine, and 2.0% (3/153)
used ecstasy. Among the poly-drug users, poppers were the most common drugs combined with other agents. No participants reported injecting drugs.

Logistic regression results showed that young (age 25–35 years vs. age ≥35 years, aOR = 3.213, 95% CI: 1.628, 6.340; age <25 years vs. age ≥35 years, aOR = 3.629, 95% CI: 1.796, 7.330), low education level (aOR = 3.671, 95% CI: 2.277, 5.918), seeking sexual partners through the internet (aOR = 1.860, 95% CI: 1.101, 3.141), seeking sexual partners through the bars (aOR = 4.813, 95% CI: 3.175, 7.297) were risk factors of club drug use (Table 2).

Sexual risk behaviors

Among the MSM surveyed, more than 40% had unprotected anal intercourse, and >80% had unprotected oral intercourse. There was no significant difference between drug users and non-users. Compared with non-drug users, 4.5% of the 177 drug-using respondents reported having paid sex with men (OR = 2.00, 95% CI: 0.83, 4.79), 10.2% reported having group sex (OR = 1.82, 95% CI: 1.01, 3.27), 2.8% had sex for money (OR = 2.67, 95% CI: 0.84, 8.50), 4.5% had sex with a foreign man (OR = 2.51, 95% CI: 1.01, 6.25), and 12.4% had sex with women in the past 6 months (OR = 0.82, 95% CI: 0.49, 1.34). Fifty-seven percent of drug-using participants and

Table 1. Characteristics of the MSM participants who used or did not use club drugs in Changsha, China.

| Factors                        | Drug users (n = 177) | Non drug use (n = 649) | Total (n = 826) | P-value |
|-------------------------------|---------------------|------------------------|-----------------|---------|
| Age (mean, year)              | 26.7±6.3            | 28.4±8.5               | 28.0±8.1        | 0.006   |
| Age (year)                    |                     |                        |                 |         |
| <25                           | 78 (44.1)           | 265 (40.8)             | 343 (41.5)      | 0.002   |
| 25–35                         | 86 (48.6)           | 265 (40.8)             | 351 (42.5)      |         |
| ≥35                           | 13 (7.3)            | 119 (18.3)             | 132 (16.0)      |         |
| Marital status                |                     |                        |                 |         |
| Single                        | 146 (82.5)          | 499 (76.9)             | 645 (78.0)      |         |
| Married/cohabitant            | 27 (15.3)           | 115 (17.7)             | 142 (17.2)      | 0.173   |
| Separated/divorced/widowed    | 4 (2.2)             | 35 (5.4)               | 39 (4.8)        |         |
| Education                     |                     |                        |                 |         |
| Middle school or less         | 48 (27.1)           | 62 (9.6)               | 110 (13.3)      | 0.000   |
| High school or higher         | 129 (72.9)          | 587 (90.4)             | 716 (86.7)      |         |
| Income (yuan/month)           |                     |                        |                 |         |
| <1000                         | 38 (21.5)           | 150 (23.1)             | 188 (22.7)      |         |
| 1000–                         | 57 (32.2)           | 252 (38.8)             | 309 (37.4)      | 0.123   |
| ≥3000                         | 82 (46.3)           | 247 (38.1)             | 329 (39.9)      |         |
| Sexual orientation            |                     |                        |                 |         |
| Homosexual                    | 110 (62.1)          | 383 (59.0)             | 493 (59.7)      |         |
| Bisexual                      | 44 (24.8)           | 204 (31.4)             | 248 (30.0)      | 0.152   |
| Uncertain                     | 2 3 (13.1)          | 62 (9.6)               | 85 (10.3)       |         |
| Venues for meeting sex partners |                   |                        |                 |         |
| Internet                      | 153 (86.4)          | 517 (79.7)             | 670 (81.1)      |         |
| Bathhouses                    | 8 (4.5)             | 38 (5.9)               | 46 (5.5)        |         |
| Bars and clubs                | 68 (38.4)           | 66 (10.2)              | 134 (16.2)      | 0.000   |
| Parks and toilet              | 4 (2.3)             | 29 (4.5)               | 33 (4.0)        |         |
| Dance halls                   | 10 (5.6)            | 21 (3.2)               | 31 (3.7)        |         |

Data are presented as number (%).

doi:10.1371/journal.pone.0126320.t001
41.0% of non-drug users reported multiple sex partners (OR2-4 partners vs. 1 partner = 1.77 95%CI: 1.26, 2.52; OR>5 partners vs. 1 partner = 2.57; 95%CI: 1.29, 5.13; Table 3).

The main places that drug users and non-drug users met their sex partners were via the internet (86.4% vs. 79.7%, respectively), bars and clubs (38.4% vs. 10.2%), dance halls (5.6% vs. 3.2%), and bathhouses (4.5% vs. 5.9%).

HIV/STD prevalence and risk factors analysis

The prevalence of HIV, syphilis, and herpes simple virus 2 infections were higher among drug users compared with non-users. The positive rate of HIV among drug users and non-users was 18.6% and 10.6%, respectively (OR = 1.93; 95%CI: 1.22, 3.03). The prevalence of syphilis was 12.4% (22/177) and 6.0% (39/649), respectively (OR = 2.22; 95%CI: 1.28, 3.86). The prevalence of HSV-2 among drug users and non-users was 16.9% (30/177) and 12.8% (83/649), respectively (OR = 1.39; 95%CI: 0.88, 2.19) Nineteen point eight percent of drug users and 10.3% of non-users had self-reported STD-related symptoms during their lifetime (OR = 2.14; 95%CI: 1.37, 3.35; Table 4).

Multivariate analysis was used to identify the factors associated with HIV/STD infection by controlling some possible confounding factors. HIV/STD infection (yes/no) was employed as the dependent variable. The participants with any positive results of HIV, Syphilis or HSV-2 test were categorized as HIV/STD positive group, otherwise as HIV/STD negative group. Age, education, unprotected anal sex, unprotected oral sex, group sex, sex with foreigners, number of sex partners, and club drug use were used as the independent variables. Table 5 indicated that HIV/STD infection was significantly associated with age [age 25~35 years VS age <25 years (aOR = 1.520, 95%CI:1.062, 2.176); age ≥35 years vs. age <25 years((aOR = 2.531,95%CI: 1.609,3.983)], and drug use (aOR = 1.946, 95%CI: 1.346,2.815). MSM with old age and using club drugs were more likely to have the HIV/STD infection.

Table 2. Factors associated with club drug use among MSM in Changsha, China.

| β     | Wald x² | P-value | aOR  | 95%CI lower | upper |
|-------|---------|---------|------|-------------|-------|
| Age group |         |         |      |             |       |
| <25   | 1.289   | 12.908  | 0.000| 3.629       | 1.796 | 7.330 |
| 25~   | 1.167   | 11.325  | 0.001| 3.213       | 1.628 | 6.340 |
| ≥35(R) |         |         |      |             |       |
| Education |       |         |      |             |       |
| Middle school and less | 1.300 | 28.469  | 0.000| 3.671       | 2.277 | 5.918 |
| High school(R) |       |         |      |             |       |
| Seeking partner through the internet |         |         |      |             |       |
| No(R) |         |         |      |             |       |
| Yes   | 0.620   | 5.379   | 0.020| 1.860       | 1.101 | 3.141 |
| Seeking partner through the bars |         |         |      |             |       |
| No(R) |         |         |      |             |       |
| Yes   | 1.571   | 54.761  | 0.000| 4.813       | 3.175 | 7.297 |
| constant | -4.029 | 59.139  | 0.000| 0.018       |       |       |

Note: R: reference group

doi:10.1371/journal.pone.0126320.t002
Table 3. Risky sexual behaviors in MSM who used or did not use club drugs in Changsha, China.

| Factors                                      | Drug use (n = 177) | Non drug use (n = 649) | p-value | OR (95%CI) |
|----------------------------------------------|-------------------|------------------------|---------|------------|
| Unprotected anal intercourse with men (last sexual contact) |                   |                        |         |            |
| Yes                                          | 74 (43.8)         | 278 (42.8)             | 0.806   | 0.96 (0.68,1.34) |
| No                                           | 103 (56.2)        | 371 (57.2)             |         |            |
| Unprotected oral sex (last sexual contact)    |                   |                        |         |            |
| Yes                                          | 158 (89.3)        | 549 (84.6)             | 0.117   | 1.52 (0.90,2.55) |
| No                                           | 19 (10.7)         | 100 (15.4)             |         |            |
| Paid sex with men in the past 6 months        |                   |                        |         |            |
| Yes                                          | 8 (4.5)           | 15 (2.3)               | 0.113   | 2.00 (0.83,4.79) |
| No                                           | 169 (95.5)        | 634 (97.7)             |         |            |
| Sex for money with men in the past 6 months   |                   |                        |         |            |
| Yes                                          | 5 (2.8)           | 7 (1.0)                | 0.085   | 2.67 (0.84,8.50) |
| No                                           | 172 (97.2)        | 642 (99.0)             |         |            |
| Sex with women in the past 6 months           |                   |                        |         |            |
| Yes                                          | 22 (12.4)         | 96 (14.8)              | 0.426   | 0.82 (0.49,1.34) |
| No                                           | 155 (87.6)        | 553 (85.2)             |         |            |
| Sex with a foreign man                        |                   |                        |         |            |
| Yes                                          | 8 (4.5)           | 12 (1.8)               | 0.04    | 2.51 (1.01,6.25) |
| No                                           | 169 (95.5)        | 637 (98.2)             |         |            |
| Group sex in the past 6 months                |                   |                        |         |            |
| Yes                                          | 18 (10.2)         | 38 (5.8)               | 0.043   | 1.82 (1.01,3.27) |
| No                                           | 159 (89.8)        | 611 (95.1)             |         |            |
| Number of male sex partners in the past 6 months |                 |                        |         |            |
| 1                                            | 77 (43.5)         | 382 (58.8)             | 0.001   |            |
| 2–4                                          | 86 (48.5)         | 240 (37.0)             |         | 1.77 (1.26,2.52) |
| 5+                                           | 14 (8.0)          | 27 (4.2)               |         | 2.57 (1.29,5.13) |

Data are presented as numbers (%)

doi:10.1371/journal.pone.0126320.t003

Table 4. Prevalence of HIV/STIs among drug and non-drug using participants.

| Factors                  | Drug use (n = 177) | Non drug use (n = 649) | P-value | OR (95%CI) |
|--------------------------|-------------------|------------------------|---------|------------|
| HIV infection            |                   |                        |         |            |
| Yes                      | 33 (18.6)         | 69 (10.6)              | 0.004   | 1.93 (1.22,3.03) |
| No                       | 144 (81.4)        | 580 (89.4)             |         |            |
| Syphilis                 |                   |                        |         |            |
| Yes                      | 22 (12.4)         | 39 (6.0)               | 0.004   | 2.22 (1.28,3.86) |
| No                       | 155 (87.6)        | 610 (94.0)             |         |            |
| HSV-2                    |                   |                        |         |            |
| Yes                      | 30 (16.9)         | 83 (12.8)              | 0.153   | 1.39 (0.88,2.19) |
| No                       | 147 (83.1)        | 566 (87.2)             |         |            |
| STD-related symptoms     |                   |                        |         |            |
| Yes                      | 35 (19.8)         | 67 (10.3)              | 0.001   | 2.14 (1.37,3.35) |
| No                       | 142 (80.2)        | 582 (89.7)             |         |            |

Data are presented as numbers (%)

doi:10.1371/journal.pone.0126320.t004
Discussion

The current study revealed that 21.4% of MSM had a history of drug use during the past six months, similar to the study in Shenyang[22] and Washington DC [23]. Among Changsha MSM, poppers were the most commonly used single drug and poly-drug combinations, compared with methamphetamine in other six Chinese cities[24], ecstasy in Shanghai[25], and poppers in Shenyang[22]. This might be because poppers relax rectal muscles to reduce dyspareunia, and are cheaper and more easily accessible in the market and on the internet in China. In addition, local developed entertainment industries and popular club culture might be contributing factors.

The results also revealed that MSM with the low level of education, younger age, seeking partners through the internet or bars were more likely to use club drugs. This suggests that drug use surveillance and intervention targeted this group of MSM are of increased importance [26].

Although there were no significant differences in unprotected sexual intercourse and condom use between drug users and non-users, more drug users reported the experience of having sex intercourse with foreigner, multiple sex partners, and group sex. Our results had also shown club drug use was correlated with HIV/STD infection and might increase the risk of HIV/STD transmission, which was in keeping with previous findings among MSM in developed countries[27,28]. Although it is difficult to judge whether the links reported here are cause-effect, these results still hint the presence of the relationship among HIV/STD infection, sexual risk behaviors, and drug use in Chinese MSM. Consistent with this, a multicenter AIDS cohort study also found that individuals that use poppers and methamphetamine are 2.10- and 1.46-times more likely to be HIV-positive[29]. Because most drug users in the current study used poppers alone or in combination with other drugs, the association between drug use and HIV/STD infections mainly reflects the effects of poppers. These results confirm that the use of poppers could increase the risk of infection with HIV/STD among Chinese MSM. Therefore, interventions for HIV/STD among Changsha MSM should consider the management and surveillance of club drugs, particularly popper use, and develop novel targeted HIV prevention strategies for drug-using MSM.

Study Limitations

There are some limitations for the current study that should be considered. The participants were recruited by a convenient sample, although attempts were made to reduce selection bias using multiple recruitment techniques, the younger, single MSM were more likely attracted in...

Table 5. Factors associated with HIV/STD infection among MSM in Changsha, China.

| Age group | β    | Wald χ²  | P-value | aOR  | 95% CI lower | 95% CI upper |
|-----------|------|----------|---------|------|--------------|--------------|
| <25 (R)   |      |          |         |      |              |              |
| 25~       | 0.419| 5.228    | 0.022   | 1.520| 1.062        | 2.176        |
| ≥35       | 0.929| 16.126   | 0.000   | 2.531| 1.609        | 3.983        |
| Drug use  |      |          |         |      |              |              |
| No (R)    |      |          |         |      |              |              |
| Yes       | 0.666| 12.511   | 0.000   | 1.946| 1.346        | 2.815        |
| constant  | -1.591| 115.126  | 0.000   | 0.204|              |              |

Note: R: reference group; doi:10.1371/journal.pone.0126320.t005
the study. The cross-sectional study design also makes it difficult to make a causal inferences between the club drug use and HIV/STI. Finally, much sensitive private self-report information such as the number of sex partners and condom use, might have information bias.

Despite the aforementioned limitations, the current study is one of a small number of re-
ports that assess the prevalence of club drug use and the association between club drug use and HIV/STD infections in China. The researching information will be helpful to develop effective behavioral interventions to reduce club drug use and the sexual transmission of HIV in China.

**Supporting Information**

S1 File. Complete dataset. (XLS)

**Acknowledgments**

The authors thank the study participants and the staff in Hunan Centers of Disease Control and Prevention for their support.

**Author Contributions**

Conceived and designed the experiments: XL XC. Performed the experiments: JZ JH JSZ. Ana-
alyzed the data: JSZ GZ. Contributed reagents/materials/analysis tools: XT. Wrote the paper: XC XL.

**References**

1. State council AIDS Working Committee Office, China Ministry of Health, UN Theme Group on HIV/ AIDS in China. A Joint Assessment of HIV/AIDS Prevention, Treatment and Care in China. Beijing, China.2007. Available:http://www.chinaids.org.cn/yqjc/.
2. Ministry of Health, People’s Republic of China:2009 estimates for the HIV/AIDS epidemic in China.2009; Available:http://www.chinaids.org.cn/yqjc/.
3. Li HM, Peng RR, Li J, Yin YP, Wang BX, Cohen MS, et al. HIV Incidence among Men Who Have Sex with Men in China: A Meta-Analysis of Published Studies. PLoS ONE. 2011; 6(8):e23431 doi:10.1371/ journal.pone.0023431 PMID: 21887251
4. Ma X, Zhang Q, He X, Sun W, Yue H, Chen S, et al. Trends in prevalence of HIV, syphilis, hepatitis C, hepatitis B, and sexual risk behavior among men who have sex with men. Results of 3 consecutive respondent-driven sampling surveys in Beijing, 2004 through 2006. J Acquir Immune Defic Syndr. 2007; 45:581–587. PMID:17577125
5. Ruan Y, Li D, Li X, Qian HZ, Shi W, Zhang X, et al. Relationship Between Syphilis and HIV Infections Among Men Who Have Sex With Men in Beijing, China. Sex Transm Dis.2007; 34:592–597. PMID: 17325622
6. Bai H, Huan X, Tang W, Chen X, Yan H, Liu X, et al. A survey of HIV infection and related high-risk factors among men who have sex with men in Suzhou, Jiangsu, China. J Biomed Res.2011; 25:17–24. doi: 10.1016/S1674-8301(11)60002-X PMID: 23554667
7. Halkitis PN, Palamar JJ, Mukherjee PP. Poly-club-drug use among gay and bisexual men: a longitudinal analysis. Drug Alcohol Depend.2007, 89:153–160. PMID: 17267140
8. Schwarze S, Scheer S, McFarland W, Katz M, Valleroy L, Chen S, et al. Prevalence of HIV infection and predictors of high-transmission sexual risk behaviors among men who have sex with men. Am J Public Health. 2007; 97:1067–1075. PMID: 17463984
9. Semple SJ, Zians J, Strathdee SA, Patterson TL. Sexual marathons and methamphetamine use among HIV-positive men who have sex with men. Arch Sex Behav. 2009; 38:583–90. doi: 10.1007/ s10508-007-9292-y PMID: 18185990
10. Spindler HH, Scheer S, Chen SY, Klausner JD, Katz MH, Valleroy LA et al. Viagra, methamphetamine, and HIV risk: results from a probability sample of MSM, San Francisco. Sex Transm Dis. 2007; 34:586– 591. PMID: 17334264
11. Bolding G, Hart G, Sherr L, Elford J. Use of crystal methamphetamine among gay men in London. Addiction. 2006; 101:1622–30. PMID:17034442
12. Drumright LN, Little SJ, Strathdee SA, Slymen DJ, Araneta MR, Malcarne VL, et al. Unprotected anal intercourse and substance use among men who have sex with men with recent HIV infection. J Acquir Immune Defic Syndr.2006; 43:344–50. PMID:16980913
13. Operario D, Choi KH, Chu PL, McFarland W, Secura GM, Behel S, et al. Prevalence and correlates of substance use among young Asian Pacific Islander men who have sex with men. Prev Sci.2006; 7:19–29. PMID:16435077
14. Liu Shusen, Detels Roger. Recreational Drug Use: An Emerging Concern Among Venue-Based Male Sex Workers in China. Sexually Transmitted Diseases.2012; 39:251–252. doi:10.1097/OLQ.0b013e31824a0903 PMID: 22421689
15. Ding YY, He N, Detels R. “Circumstances of initiation into new-type drug use among adults in Shanghai: are there differences by types of first new-type drug used?” Drug and Alcohol Dependence.2013; 131,278–283. doi: 10.1016/j.drugalcdep.2012.12.019 PMID: 23312339
16. Ding YY, He N. Club drugs and HIV/STI infection: a new public health concern in China. Fudan Univ J Med Sci.2012; 39:551–557.
17. Xu JJ, An MH, Han XX, Jia MH, Ma YL, Zhang M, et al. Prospective cohort study of HIV incidence and molecular characteristics of HIV among men who have sex with men (MSM) in Yunnan Province, China. BMC Infectious Diseases.2013; 13:3.
18. Xu JJ, Reilly KH, Lu CM, Ma N, Zhang M, Chu ZX, et al. A cross-sectional study of HIV and syphilis infections among male students who have sex with men (MSM) in northeast China: implications for implementing HIV screening and intervention programs. BMC Public Health.2011; 11:287.
19. McCambridge J, Mitcheson L, Winstock A, Hunt N. Five-year trends in patterns of drug use among people who use stimulants in dance contexts in the UK. Addiction. 2005; 100:1140–1149. PMID: 16042644
20. Barrett SP, Darredeau C, Pihl RO. Patterns of simultaneous polysubstance use in drugusing university students. Human Psychopharmacology: Clinical & Experimental.2006; 21:255–263.
21. Kerr T, Fairbairn N, Tyndall M, Marsh D, Li K, Montaner J, et al. Predictors of nonfatal overdose among a cohort of polysubstance-using injection drug users. Drug and Alcohol Dependence.2007; 87:39–45. PMID: 16959438
22. Xu JJ, Qian HZ, Chu ZX, Zhang J, Hu QH, Jiang YJ, et al. Recreational Drug Use among Chinese Men Who Have Sex with Men: A Risky Combination with Unprotected Sex for Acquiring HIV Infection.. BioMed Research International, 2014; Article ID 725361, 9 pages. http://dx.doi.org/10.1155/2014/725361.
23. Li Y, Baker JJ, Korostyshesvski VR, Slack RS, Plankey MW. The Association of Intimate Partner Violence, Recreational Drug Use with HIV Seroprevalence among MSM. AIDS and Behavior. 2012; 16: 491–498. doi: 10.1007/s10461-012-0157-6 PMID: 22327371
24. Li XF, Zhang BC, Yu ZC, Tang ZL, Li Y, Zhou SJ, et al. A survey on condom use and related behaviors among 1295 men who have sex with men in six cities of China. Chinese Journal of AIDS & STD.2010; 16: 449–452.
25. He N, Wong FY, Huang ZJ, Ding Y, Fu C, Smith BD, et al. HIV risks among two types of male migrants in Shanghai, China: money boys vs. General male migrants. AIDS. 2007; Suppl: 8:S73–79.
26. Li X H, He GP, Wang HH, Williams AB. Consequences of Drug Abuse and HIV/AIDS in China: Recommendations for Integrated Care of HIV-Infected Drug Users. AIDS patient care and STDs.2009; 23:877–884. doi: 10.1089/apc.2009.0015 PMID: 19799494
27. Rudy ET, Shoptaw S, Lazzar M, Bolan RK, Tilekar SD, Kerndt PR. Methamphetamine use and Other Club Drug use Differ in Relation to HIV Status and Risk Behavior Among Gay and Bisexual Men. Sex Transm Dis.2009; 36: 693–695. doi: 10.1097/OLQ.0b013e3181ad54a3 PMID: 19704399
28. Carey JW, Mejia R, Bingham T, Ciesielski C, Gelaude D, Herbst JH, et al. Drug Use, High-Risk Sex Behaviors, and Increased Risk for Recent HIV Infection Among Men Who Have Sex with Men in Chicago and Los Angeles. AIDS and Behavior.2009; 13:1084–1096. doi: 10.1007/s10461-008-9403-3 PMID: 18498049
29. Plankey MW, Ostrow DG, Stall R, Cox C, Li X, Peck JA, et al. The relationship between methamphetamine and popper use and risk of HIV seroconversion in the multicenter AIDS cohort study. J Acquir Immune Defic Syndr.2007; 45:85–92. PMID: 17325605